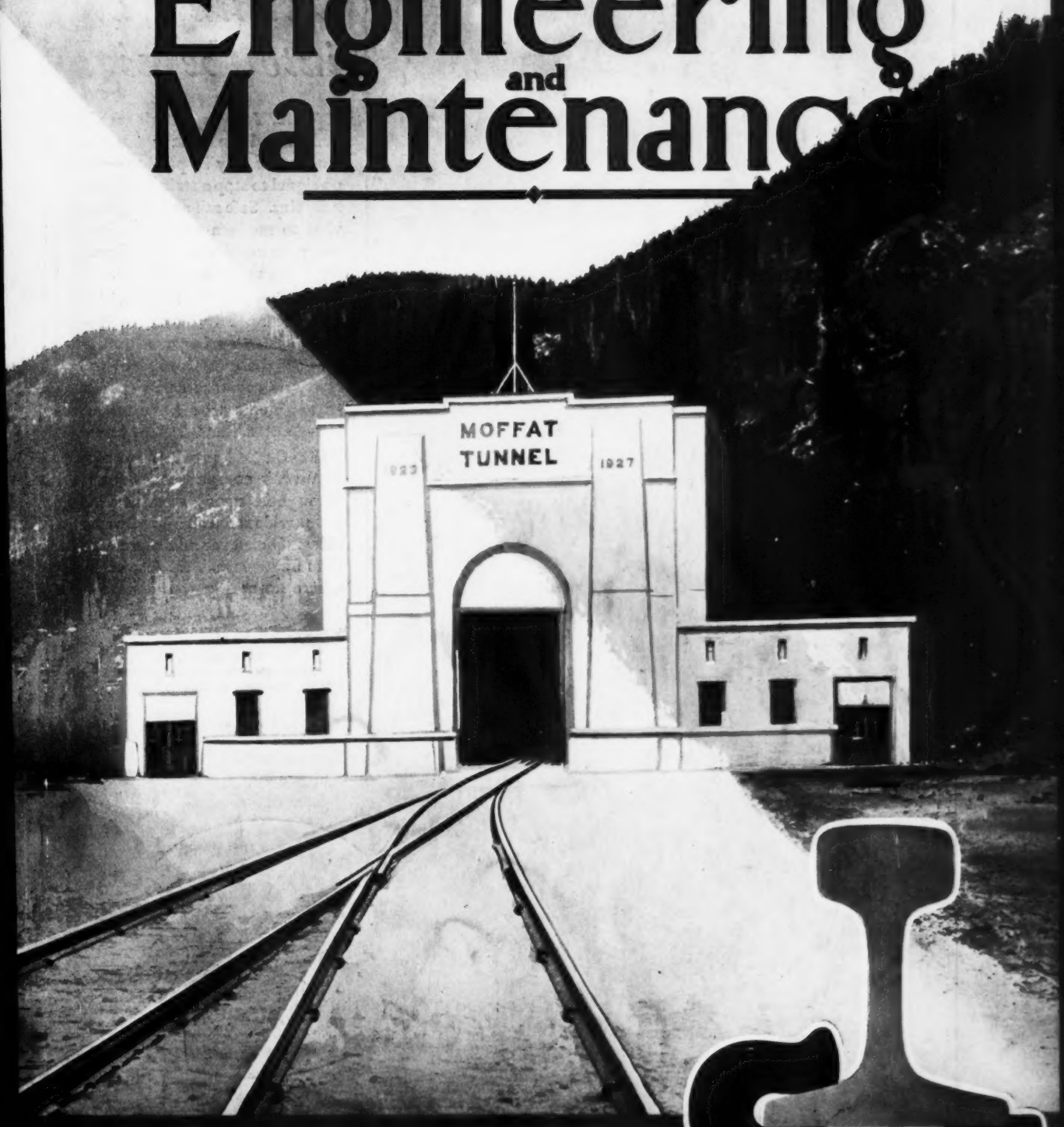
In Two Parts
Part One

Railway Engineering and Maintenance

January, 1931



RAILWAY ENGINEERING AND MAINTENANCE
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Alphabetical Index to Advertisers, Page 90 Classified Index to Advertisers, 86-88

MONEY SAVING TIE PLATES

FOR 1931 ECONOMY BUDGETS

IN THIS age of tie conservation, the Lundie Tie Plate is, without doubt, a necessity. It costs less to use than to do without. The Lundie Plate is a proven economic device which pays for itself over and over again by protecting ties against mechanical wear and prolonging their life in track. These economies are not limited to the year of purchase but extend through all future years. The economies keep on multiplying.

The outstanding Lundie feature is the design of the bottom. The complete elimination of sharp tie destroying projections assures 100 per cent service from treated ties.

Be sure to specify the Lundie Tie Plate in your 1931 budget.

The Lundie Engineering Corp.
285 Madison Avenue, New York
59 East Van Buren Street, Chicago

LUNDIE TIE PLATE

No. 1 of a Series Contributed by Leading Railroads

. . . . And Thus America Became a Unified Nation

Farsighted were the men who founded the Baltimore & Ohio Railroad, but it took the age-dimmed eyes of Charles Carroll to see the real importance of tracks leading to the west. When laying the cornerstone on July 4, 1828, he spoke little of the courage of this enterprise or of the profit to result. He said simply, "This is my second great step for my country."

Fifty-two years before he had signed the document that freed the states—but the *unifying* of those states into a nation, he foresaw, could be accomplished only through the railroads, which would break down distances, and the differences which separated men's minds.

True to his predictions the Baltimore & Ohio Railroad wrote a new chapter in American History. Other great systems followed. An all-embracing network of steel sprang across the country—stretched South, North and West until it measured a quarter of a million miles . . . In that century of growth, the Railroads made America the greatest, richest and most *centralized* nation on the face of the earth.

THE RAILROAD WORLD

A TRIBUTE TO TRADITION

From each generation of railroad men to the next there has passed the Great Tradition of Service—a tradition born of sublime courage, fostered in daring achievement, and crowned with success in spite of the greatest physical and financial obstacles. It will be our privilege in these pages and in succeeding issues to recount the events which have glorified that tradition in American eyes.

Fairmont, too, has a Tradition to follow—*Lowest Over-all Cost!* For years Fairmont has dared to sell Railway Motor Cars on that basis, arrived at by adding total upkeep to initial cost, and dividing by number of years in service.

The result has been—Over half the motor cars now in railroad service are Fairmont products!

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FAIRMONT RAILWAY MOTORS, Ltd., Toronto, Canada
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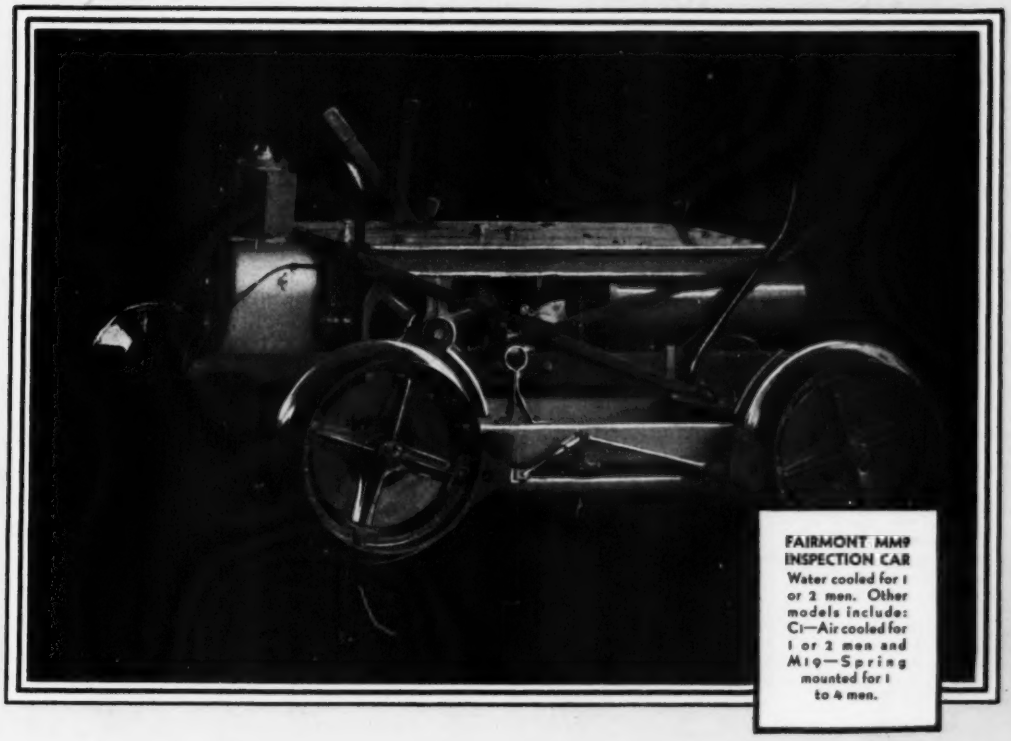
Manufacturers of section motor cars, inspection motor cars, gang and power cars, weed burners, mowers, ballast dischers, ball and roller bearing engines, push cars and trailers, roller axle bearings, wheels, axles and safety appliances.

Fairmont Mudge
Performance on the Job Counts



FAIRMONT MM9 INSPECTION CAR
Water cooled for 1 or 2 men. Other models include: C1—Air cooled for 1 or 2 men and M19—Spring mounted for 1 to 4 men.

KNOWS FAIRMONT

A Crawler that really steers!

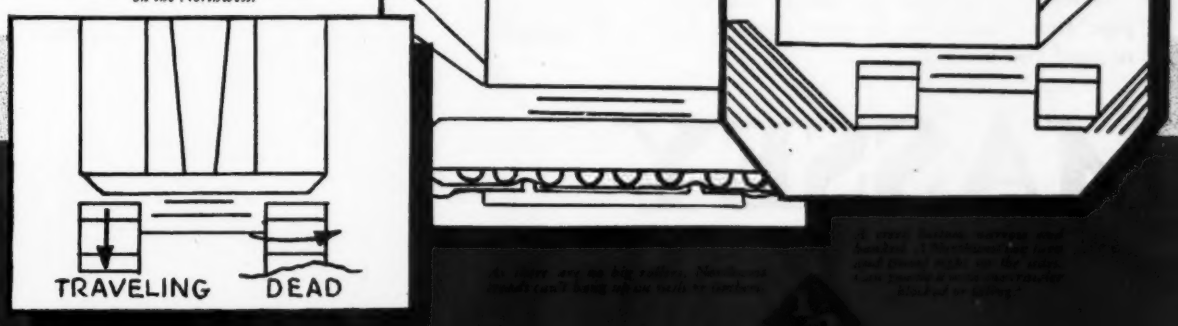
It's not a question of a long or short curve. The long curve of the Northwest simply demonstrates the full power of Northwest traction.

As both crawler have power behind them the tendency is to continually climb on top. The resistance to cutting through the surface soil is reduced and the speed greatly increased.

AS illustrated by the pictured tread trail—positive power drives both crawlers *even while turning.*

This power on the curves makes the Northwest a sure-footed unit that negotiates rails, mud, inclines to cars and creek bottoms with an ease impossible where a machine is crippled by blocking one or the other crawler in turning!

The great strains that come with the live crawler forcing the massive weight of a dead one around, as is the case with the ordinary steering method, is eliminated on the Northwest.

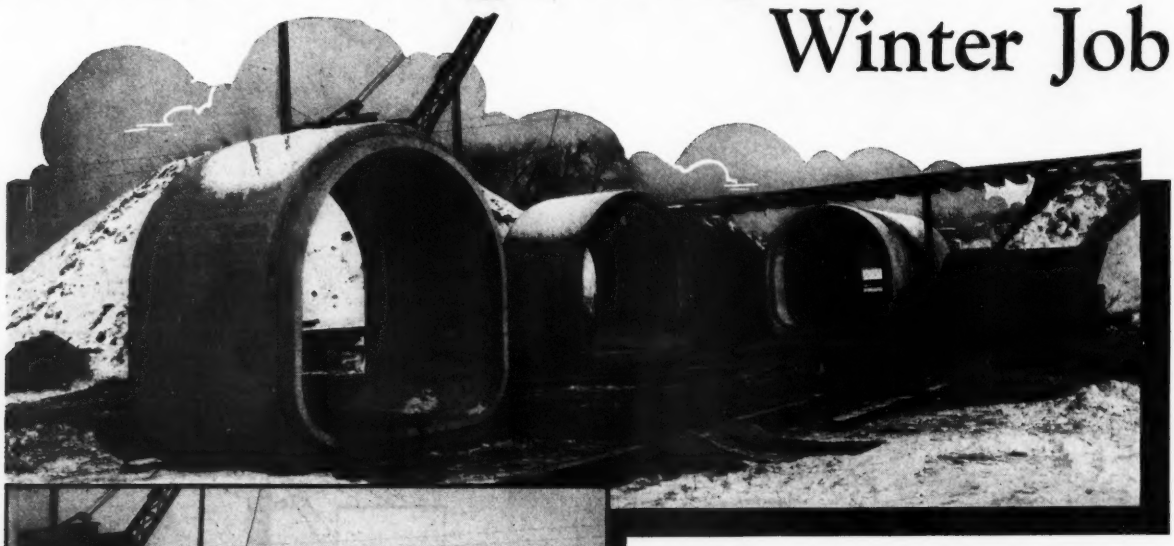


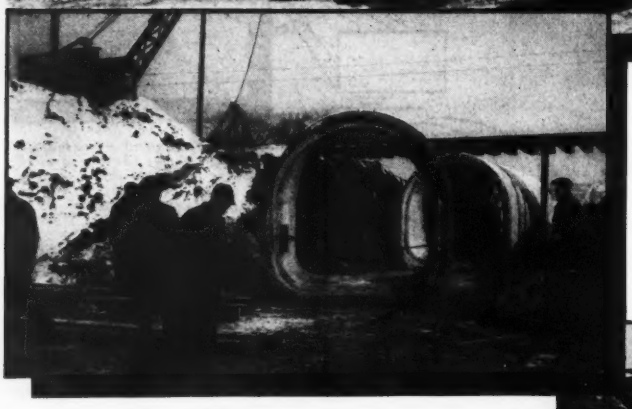
NORTHWEST ENGINEERING CO.

1713 Steger Bldg., 28 E. Jackson Blvd., Chicago, Ill., U.S.A.

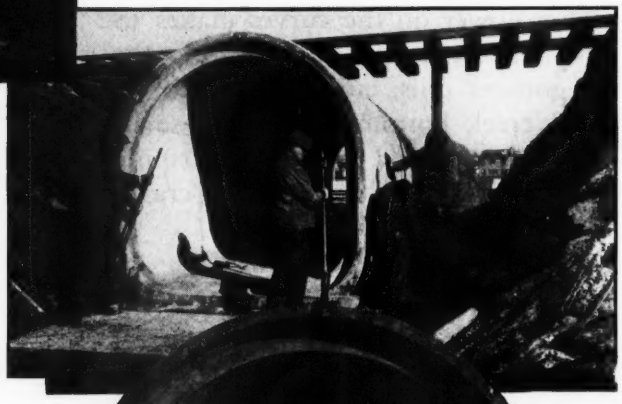
NORTHWEST

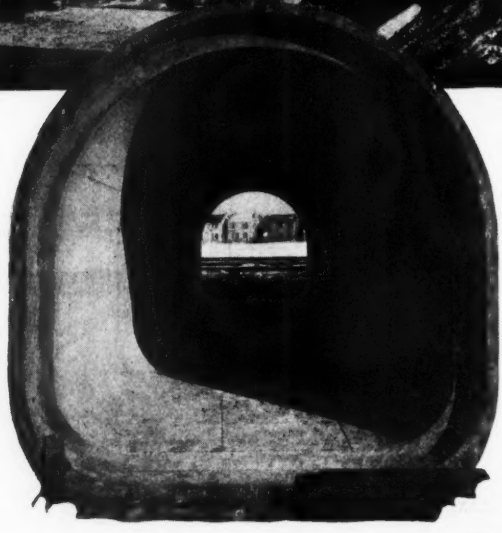
Modern Bridge Gang on a Winter Job





Pedestrian subways, cattle passes, culverts, and crib retaining walls can be installed in any season by the use of Massey precast concrete products.





IN THE accompanying views a line of Massey 91″x91″ flat base pipe is being laid for a pedestrian subway under new tracks. No forms to build; no concrete to mix; no special equipment but the light gasoline crane.

There is a booklet on Massey flat base pipe that should be in your hands. Let us send you a copy.

MASSEY

CONCRETE PRODUCTS CORPORATION

Peoples Gas Building

Chicago, Illinois

Sales Offices:

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310 Dominion Sq. Bldg., 1010 St. Catherine St., West, Montreal, Que.

RE&M-1-Gray

NIVOSAL

THE NEW THAWING AGENT

Melts Ice and Snow "Right Now"

JUST sprinkle powdered Nivosal in a thin layer on ice-bound frogs and switches. They will thaw out immediately . . . Nivosal is a granular powder,—a thawing agent which was developed for and has met with unusual success on the German Government Railways . . . Melts ice quickly at 17° below and actually thaws down to 27° below . . . Will not corrode iron or steel—saves labor—saves expensive equipment—does the job quickly. A few men can keep all the switches open in a big yard. Safe. Simple to apply . . . Spreading or dusting devices for applying furnished if desired.

Send for a trial order

MONMOUTH CHEMICAL CORP.
120 Wall St., New York
550 W. Roosevelt Rd., Chicago

USED TO REMOVE ICE ON—
Switches
Frogs
Guard Rails
Track Pans
Flange ways on highway crossings
Platforms
Signal equipment
Water cooler drains
Telegraph wires
Water barrels

NIVOSAL · *for use wherever ice and snow must be removed*

Retaining wall erected by the Pennsylvania Railroad at Pittsburgh, of Federal 2-Piece Concrete Cribbing Units. Note the splendid curve produced with this construction, through the use of standard units. The above is but one of many similar walls erected by this road over a period of years.

5 Ways to Save *on Retaining Wall Costs*

When you need an extra track, or for other reasons wish to conserve your right of way, you usually proceed to build a good retaining wall. Savings can be made when you come to select the wall itself. For instance, by using precast cribbing you

—save the cost of all form work necessary for a poured wall, as well as stripping and rubbing the face.

—save on expensive foundations required for a poured wall.

—save through 100% salvage value if you wish to move the wall.

By using Federal 2-Piece Cribbing, you

—save on the cost of material and the labor to handle three or more units.

—save on maintenance costs by using a *CLOSED FACE* construction.

All these are tangible economies, that come from the use of Federal 2-Piece Concrete Cribbing, producing a strong, stable, permanent wall at low cost—a fact proven by some of the country's most prominent railroads, who have had Federal walls in service for some time.

Send for booklet.

FEDERAL-AMERICAN CEMENT TILE CO.

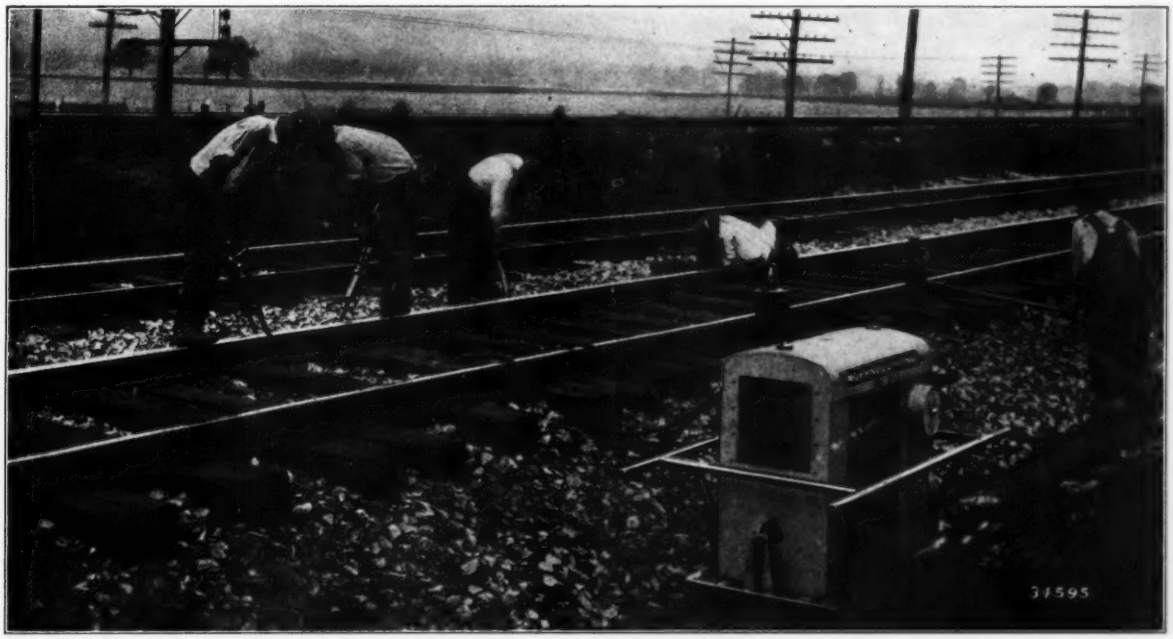
Executive Offices: 608 South Dearborn Street - - - - - Chicago

Plants Near CHICAGO - NEW YORK - PITTSBURGH - BIRMINGHAM

Concrete Products *for Over 25 Years*

FEDERAL 2 piece Concrete CRIBBING

"SPOTTAMPER"



Smoothing up track with the SPOTTAMPER

A Pneumatic Tie Tamping Unit for "picking up" low spots in track

The SPOTTAMPER is a small two-tool portable tie tamping unit that has recently been added to the Ingersoll-Rand line of labor-aiding track tools and machines.

It is designed primarily for smoothing up track. It fulfills a need long recognized by maintenance men. It can also be used to advantage for white washing, painting, sand blasting, light bridge repairs, etc.

A special mounting is provided for the compressor for moving it along a rail or rolling it along on a plank. Hand rails are also furnished to aid in handling.

. Let us send you a further description of the SPOTTAMPER and its uses.

INGERSOLL-RAND COMPANY - 11 Broadway - New York City

Branches or distributors in principal cities the world over

For Canada Refer—Canadian Ingersoll-Rand Co., Limited, 10 Phillips Square, Montreal, Quebec.

285-TT

Ingersoll-Rand

A Brilliant Newcomer

ready to make your acquaintance

New but with an unparalleled background of experience and an array of field tested improvements—the new 43-B 1½-yard machine is ready to tackle the hard jobs of 1931.

Here are some of its profit making features—

1. Speed, power and stability combined to make a 1½-yard shovel, dragline, clamshell or lifting crane with operating speeds of a much smaller machine.
2. Easiest possible convertibility.
3. Special extra-long and wide mountings for soft ground dragline work.
4. All continuously running shafts mounted on ball bearings.
5. Reversing bevel gears for swinging and propelling, completely enclosed and running in oil . . . ball bearing mounted in one rugged casting that prevents spreading of bevel-gears and insures permanent alignment.
6. Hoist clutches power set—all operating levers toggle set.
7. Transmission and swing reversing-gears, and all gears low-deck, enclosed and running in oil.
8. Gasoline, Diesel or electric power.

Send for the 43-B Bulletin, today.

A-222—1-31—REM

BUCYRUS ERIE

BUCYRUS-ERIE COMPANY
South Milwaukee, Wis.
Offices or distributors in principal cities

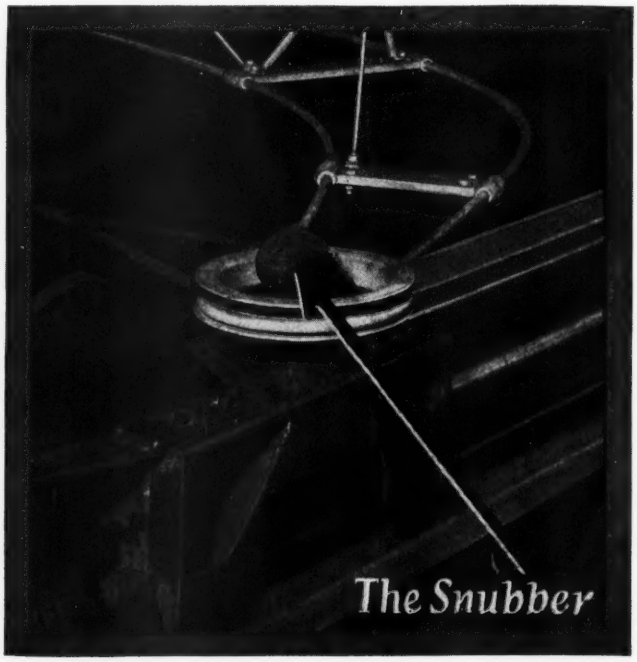
1/2-yard
5/8
3/4
7/8
1
1-1/4
1-1/2
1-3/4
2
2-1/4
2-1/2
3
3-1/2
4
4-1/2
5 and up to 16 yards

Shovels
Draglines
Clamshells
Lifting Cranes
Dragshovels
Magnet Cranes
Tunnel Shovels
Dredges
Dragline Buckets

Gasoline
Diesel
Gas + Air
Electric
Steam
Diesel-Electric

STOPPED 608 TIMES

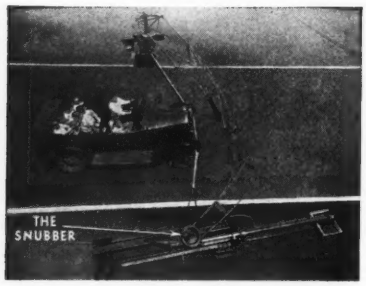
without injury to occcupants...damage to vehicles ...or to the barrier



FOR over two years, THE HIGHWAY GUARDIAN has been undergoing an accelerated test. All day long the barrier has been kept in motion, raising and lowering. Frequently a car is crashed into it.

Large cars and small ones, as well as light, medium and heavy weight trucks have hit the barrier and been stopped completely. 608 times this test has been made at speeds varying from 5 to 35 miles an hour. In each case THE HIGHWAY GUARDIAN has demonstrated its ability to prevent crossing accidents without injury to occupants...damage to vehicles...or to the barrier.

During these two years, the barrier has been raised and lowered 250,000 times. Without fail, it locks over the powerful snubber. This is equivalent to more than 14 years' service on a railroad having 50 trains every 24 hours.



The force of an impact is transmitted to a powerful snubber which immediately softens the blow. It yields, the vehicle continues forward a few feet but gradually and positively is brought to a safe stop with passengers uninjured.

From both mechanical and safety standpoints, THE HIGHWAY GUARDIAN offers a thoroughly tested and tried method of preventing crossing fatalities. It will operate for years with a minimum of attention. Maintenance amounts to practically nothing. THE HIGHWAY GUARDIAN is interestingly described in Bulletin No. 750. Write for a copy.

The fundamental idea from which THE HIGHWAY GUARDIAN has been developed was the ingenious conception of Mr. Joseph B. Strauss, eminent consulting engineer and builder of many of the world's famous bridges

Franklin Railway Supply Company, Inc.

New York Chicago St. Louis San Francisco Montreal

PREFERRED, BECAUSE PROVED

Strength to spare and many years of trouble-free service. A 72-inch Armco Culvert under a railroad in Ohio.

SAFER STRONGER! MORE ENDURING!

THROUGHOUT America, many railroads have abandoned their experiments with culverts and settled upon Armco Corrugated Iron Pipe as the *logical* product . . . logical because proved by every test to be *safer* —safer because stronger—and *longer-lasting* because made of pure iron.

Some of the greatest railroads in the United States use Armco Culverts exclusively! Their preference is based strictly on the *safe economy* which this champion product assures. They *know* that Armco Culverts hold the record for durability among culverts of their type—25 years to date in "Nature's laboratory," under all conditions of service.

In 1931 other railroads are adding to their use of Armco Culverts, while still others—now convinced by their own tests and those conducted by engineering authorities—are changing over to this uniformly pure iron drainage product.

Facts on the performance of various kinds and types of pipe verify the superiority of Armco Culverts. Armco engineers in your vicinity, or Drainage Headquarters, will gladly cooperate to point *your* advantages in adopting this pipe.

ARMCO CULVERT MANUFACTURERS ASSOCIATION—*Middletown, Ohio*

ARMCO Culverts

Armco culverts and drains are manufactured from Armco Ingot Iron of the American Rolling Mill Company and always bear its brand.

28 SPIKES PULLED *Per* MINUTE Safely and Economically!

There's speed in the Nordberg Power Spike Puller—and saving—and safety! It pulls 24 to 28 spikes per minute. "Cut throat," "humpbacked,"—no matter what condition the spikes may be in, they instantly yield to the 10,000 pounds pull of the Nordberg.

On bridges, at switches, between guard rails and other places where it is difficult to work with claw bars, the Spike Puller will pull spikes just as efficiently as on ordinary stretches of track. And there is no danger of mashed fingers and injury from flying spike heads.

Nordberg engineers are constantly developing new devices that lead to better track and greater economies in the railway field. Some of these machines are shown here; others are being regularly added to the line.

NORDBERG MFG. CO.
Milwaukee, Wis.

NORDBERG


Nordberg Power Rail Drill


Nordberg Track Shifter


Nordberg Power Track Jack


Nordberg Adzing Machine

No. 25 of a series

PUBLISHER OF
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RAILWAY ELECTRICAL ENGINEER
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Railway
Engineering and Maintenance
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"THE HOUSE OF TRANSPORTATION"

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SAN FRANCISCO
215 MARKET STREET

ADDRESS REPLY TO
105 WEST ADAMS ST.
CHICAGO, ILL.

December 25, 1930

Dear Reader
Everywhere

Ain't it grand and
glorious to be here,
well and hearty this
Christmas 1930?
✓

And to send you
every good wish for
your prosperity, health
and contentment during
1931?
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Why Should any Crane Have a Big Expense Account?

Heavy-duty erection crane with extension boom.

PUT two salesmen out on the firing line and one will send in orders; the other chiefly expense accounts. The amount of their sales will show the difference between the "star" and just another salesman.

The above comparison is just as true of locomotive cranes as it is of men. Every crane will save considerable time and money, but some will do a lot more work than others and with lower expense accounts.

If you want to know the facts about low handling costs, ask some of the owners who keep records on their locomotive cranes. The answer to this question is the reason, of course, why far more Industrial Brownhoists are in use than any other make.

Industrial Brownhoist Corporation, General Offices, Cleveland, Ohio

District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, New Orleans, San Francisco, Cleveland.

Plants: Brownhoist Division, Cleveland; Industrial Division, Bay City, Michigan; Elyria Foundry Division, Elyria, Ohio.

INDUSTRIAL BROWNHOIST

Published on the last Thursday preceding the month of issue by the

SIMMONS-BOARDMAN PUBLISHING COMPANY

105 West Adams Street, Chicago

NEW YORK
30 Church Street

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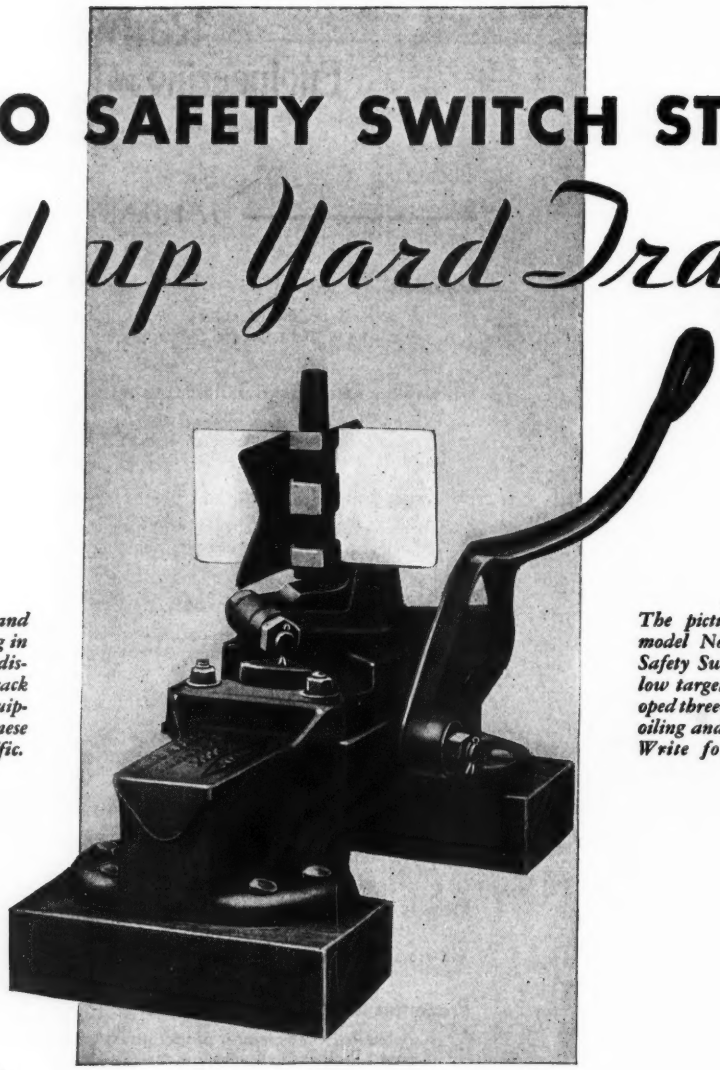
Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

JANUARY, 1931

RAMAPO SAFETY SWITCH STANDS

speed up Yard Traffic



Behind Racor Service stand nine plants specializing in the manufacture and distribution of railroad track turnout and crossing equipment, including Manganese Work for heavy traffic.

The picture at left is a model No. 20 B Ramapo Safety Switch Stand with low target. A newly developed three-piece cover makes oiling and inspection easy. Write for information.

IN THE rapid handling of cars during switching operations there is the ever-present chance of shunting cars through closed switches with resultant damage to switch points and rigid switch stands. Regardless of the known hazards of such miscalculations, and in spite of the discipline with which switching crews are imbued, mishaps of this kind are frequent. Invariably, with rigid switch stands, they result in delay and expense. This constant threat of trouble makes men over-cautious and slows up their work.

Ramapo Safety Switch Stands completely eliminate all the penalties of trailing through closed switches. When this occurs, a spring mechanism allows the points to move over under pressure of the wheel flanges and properly carry the car on its way. No damage is done to the points or to the switch stand. The target follows the points and indicates their true position, whether thrown automatically or by hand.

RACOR TRADE MARK REGISTERED

So successfully have these simple devices done their appointed task that more than 300,000 of them are in use on 300 railroads.

RAMAPO AJAX CORPORATION

Racor Pacific Frog and Switch Company . . . . Los Angeles—Seattle
Canadian Ramapo Iron Works, Limited . . . Niagara Falls, Ontario

General Offices—230 Park Avenue, New York

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Nine Racor Works: **Hillburn, N. Y., Niagara Falls, N. Y., Chicago, Ill., East St. Louis, Ill., Superior, Wis., Pueblo, Col., Los Angeles, Cal., Seattle, Wash., Niagara Falls, Ont.**

Railway Engineering and Maintenance

1930 — 1931

A Review of the Old—A Forecast of the New

The year 1930 was one of marked contrasts. It differed widely from 1929 in traffic trend and volume, in net earnings and in expenditures for the maintenance, as well as for the improvement of the roadway and structures. Within the year itself, 1930 also presented marked contrasts between the policies of expenditures for additions and betterments and for current upkeep. All in all, it was a year of marked changes.

As a result of the large amount of work that had been done on the tracks and structures in recent years, the roads entered 1930 in the best condition in their history. The year which has just closed was singularly free from labor unrest, floods and other adverse influences. In fact, the drought which worked intense hardship in many agricultural areas, reacted definitely to the advantage of track maintenance, with the result that high standards were maintained throughout the year and the roads enter 1931 in excellent shape, fully able to cope economically and efficiently with any traffic that may reasonably be expected.

Traffic Declined

In contrast with 1929, when traffic moved in record volume, the year which has just closed saw a decline of approximately 14 per cent in both freight and passenger business. By reason of this decrease in traffic, total operating revenues declined 15.5 per cent, while the rate of return on the railway property investment declined to 3.41 per cent, as compared with 4.49 per cent in 1929 and 4.71 per cent in 1928. As a result, expenditures for the maintenance of way and structures were cut 15.3 per cent.

In marked contrast to the latter figure, the roads of the United States spent more for additions and improvements to their roadway facilities, chargeable to capital account, than in any preceding year in history. In the face of the decline in traffic, the railways established new records for operating efficiency in five different respects in 1930.

Revenue car loadings in 1930 approximated 45,850,000 as compared with 52,948,000 in 1929, and with the five-year average for 1925-1929, inclusive, of 52,099,000. There were no million-car weeks in 1930, whereas there were 28 such weeks in 1929. Measured in ton miles, every month of 1930 showed a smaller total than either 1929 or the five-year average of 1925-29, while the decline from 1929 grew almost steadily greater as the year progressed.

Likewise, after showing a decrease in 1929, as compared with the preceding year, of only 1.4 per cent, passenger traffic again declined abruptly during 1930, with the result that the volume was 43 per cent below that of the record year, 1920.

By reason of this decrease in the volume of traffic handled, operating revenues declined $987,000,000 to a total of $5,365,000,000. Total operating expenses amounted to $3,985,000,000 falling below the four-billion dollar mark for the first time since 1917. The operating ratio for the year was 74.3, as compared with 71.7 in 1929.

Railway taxes decreased $46,000,000, or to $356,000,000, during 1930. However, the ratio of taxes to operating revenues rose to a new high record of 6.6 per cent. In other words, 6.6 cents of every dollar of railway revenues in 1930 went for federal, state and local taxes.

Net operating income declined from $1,275,000,000 in 1929 to $898,000,000 in 1930, a decrease of 29.6 per cent. This is the first time that this figure has fallen below $900,000,000 since 1922, while the rate of return was lower than in any year since 1921.

Maintenance Curtailed

As is to be expected in a year of sharply reduced traffic demands, the amount spent for the repair and upkeep of the properties decreased. Early in the year the reductions were not pronounced and the amounts spent for maintenance of way and structures, up to and including May, were only 7.7 per cent below those for the same period of 1929. However, as the season advanced, it became evident that traffic was not only not going to pick up, but was actually decreasing at an accelerated rate and further retrenchment measures were put in effect with the result that in October the decrease, as compared with the corresponding month of 1929, was 27 per cent.

The expenditures for maintenance of way for the year 1930 approximated $731,000,000 as compared with $862,701,000 in 1929, and an average of approximately

$859,000,000 for the five years 1925-1929. This decrease of approximately $132,000,000, or 15.3 per cent, brought the total expenditures for maintenance of way to the lowest figure since the termination of federal control, as is shown by the following:

EXPENDITURES FOR MAINTENANCE OF WAY AND STRUCTURES, CLASS I RAILROADS

1920	$1,030,504,000
1921	764,662,000
1922	736,181,000
1923	821,913,000
1924	802,673,000
1925	824,320,000
1926	877,877,000
1927	879,496,000
1928	845,612,000
1929	862,701,000
1930	731,000,000

In Excellent Condition

Drastic as was the retrenchment in the latter months of 1930, the fact remains that the properties are, as a whole, in excellent condition. This is due to several causes. In the first place, large expenditures have been made in recent years for heavier rail, treated ties, more and better ballast and other materials that provide a stronger construction and one with longer life, on which returns are now being realized in the form of decreased renewals. Likewise, the growing use of labor-saving equipment is decreasing the cost of many operations. The natural result of these factors is to decrease the cost of maintenance, even in normal times. To them were added in 1930 the prolonged drought in many areas and the reduced traffic, both materially decreasing the wear and tear on the properties. As a result of all these influences, the tracks and structures enter the new year in a condition far superior to that which a consideration of the expenditures alone would indicate.

The extent to which the track structure is being strengthened is shown by the fact that more than 75 per cent of the total tonnage of rails that is now being rolled is in sections weighing 100 lb. and heavier, as compared with 39 per cent as recently as 1921, while more than a third of the total tonnage rolled weighs 120 lb. per yard or over. Of interest in this connection was the completion last June by the Pennsylvania of the removal of all rail weighing less than 130-lb. from its main tracks between New York and Chicago. Another development in this direction during the year was the completion by the Kansas City Southern of an extended investigation of the most economical weight of rail for use on its main line, which led to the conclusion that this weight was 137 lb., or heavier than that used on any railway in America, including those with many times greater traffic density. The wide-spread interest displayed in this investigation during recent months has done much to stimulate thought in favor of a heavier track structure.

No Labor Troubles

The year was featured by an entire absence of labor shortages and of labor unrest, so frequent 15 or 20 years ago. There was a surplus of labor throughout the year that became so pronounced late in the fall that the governor of one central western state appealed to the managements of the railways in that state to return to their country those Mexicans who were in their employ in order to aid in the relief of unemployment among native residents. At no time in the year did the number of maintenance of way employees equal that of the corresponding period of the previous year, the decrease growing from 2,500 in January to more than 100,000 in the fall months.

In spite of the entire absence of a labor shortage, the development and utilization of labor-saving equipment continued throughout the year. Not only were new devices introduced in numbers, but the adoption of older devices became more universal. While some roads postponed the contemplated purchase of new equipment of this character, others saw in this equipment a means of effecting economies. As a result, the year saw little retardation in the trend towards the more universal utilization of labor-saving equipment which has been so pronounced during the last decade.

Record Improvement Expenditures

In a year of so much curtailment, the record for the enlargement and improvement of the properties stands out in marked contrast. Not only was there no evidence of retrenchment here, but the roads actually spent more for this purpose than in any year since 1923. In the first nine months of the year, this excess over the same period in 1929 exceeded $125,000,000, and the total for the year was between $875,000,000 and $900,000,000, as compared with an expenditure of $854,000,000 in 1929. In this vigorous fashion did the railways reply to President Hoover's plea for the continuation of improvement programs as a means of stabilizing business, following the stock market crash of November, 1929. Of the amounts spent for improvements chargeable to capital account during 1930, more than $545,000,000, or 62 per cent, went for roadway purposes. This amount exceeded that spent in any previous year on record, by reason of the large total volume of expenditures and also because of the trend during recent years of devoting a growing proportion of the total to roadway purposes, as shown by the following figures:

Year	Total Capital Expenditures	Expenditures for Equipment	Per Cent of Total	Expenditures for Roadway	Per Cent of Total
1923	$1,059,149,426	$681,723,991	64	$377,425,435	36
1924	874,743,228	493,608,460	56	381,134,768	44
1925	784,191,000	338,114,000	45	410,077,000	55
1926	875,000,000	380,000,000	43	495,000,000	57
1927	771,552,000	288,700,000	37	482,852,000	63
1928	676,665,000	224,301,000	33	452,364,000	67
1929	853,721,000	321,306,000	38	532,415,000	62
1930*	875,000,000	330,000,000	38	545,000,000	62

*Estimated.

New Mileage

One commonly recognized indication of the magnitude of roadway expenditures, although of decreasing importance in recent years, is the mileage of new lines completed. This totaled 513 miles in the United States in 1930, as compared with 666 miles during 1929. This mileage was smaller than in any year since 1924, but

larger than that completed in any year between 1919 and 1924. In 1930 there were also completed 236 miles of second track, 71 miles of third track and 24 miles of fourth track, as compared with 181, 40, and 10 miles respectively, in 1929. Texas led, as during the last two years, in the mileage of new lines completed, 245 miles being built within its borders during the year, while New Mexico was second with 73.5 miles. Among the longer lines completed during the year were those of the Texas & Pacific to Lovington, N. M., 73.5 miles, and the extension of the K. C. M. & O. line of the Santa Fe to Presidio, Tex., 65 miles.

In keeping with the trend in recent years, however, by far the larger part of expenditures went for that vast variety of miscellaneous projects that go to make up a railroad. Among the larger projects of this character are the New York Central's terminal improvements on the west side of Manhattan Island, which call for the relocation and elevation of tracks and the elimination of 90 grade crossings, and which will involve an ultimate estimated expenditure of $175,000,000; the electrification of the Pennsylvania's main line between New York and Philadelphia, and the reconstruction of its passenger terminals in the latter city; the electrification of the suburban lines of the Lackawanna in New Jersey and of the Reading near Philadelphia; the completion of the union passenger terminal in Cleveland, and the continuation of work on the Cincinnati Union station; the construction of freight terminals at Cheyenne, Wyo., on the Union Pacific and at Galesburg, Ill., on the Burlington; the Southern Pacific bridge across Suisun Bay, Cal.; the water treating program of the New York Central, etc.

Signaling and Train Control

Closely allied with the expenditures for roadway facilities and, to some extent eliminating the necessity for them, were the expenditures made last year for automatic signals, interlocking plants, centralized control, grade crossing protection, etc. The total number of units of signaling facilities of various kinds installed last year exceeded those for any previous year, including 3,693 miles of road equipped with automatic block signals, 106 new interlocking plants and numerous installations of centralized control, involving, among other features, the operation of 607 switches by power.

During the year the Pennsylvania extended its cab signaling between Altoona and Pittsburgh, while the Michigan Central installed automatic intermittent train stop on its lines between Windsor, Ont., and St. Thomas. In highway crossing protection, 2,982 signals and 46 automatic gates were installed during the year.

Increasing Competition

Among the problems which the railways faced more intensively in 1930 than heretofore, and which will confront them still more acutely in 1931, are those of other forms of competition—particularly on the highways and waterways. In the one the public is providing the right of way, over which buses and trucks may operate without regulation as to schedules, service or rates, while, on the other, it is not only providing at public expense the channel over which traffic may be moved, but is itself engaging in competition with the railways in the transportation of freight.

One of the encouraging developments in this problem is the fact that the railways are now awake to the menace of this competition and are initiating programs to secure fair play for the railways. Another development of equal importance is the further fact that the employees have come to a realization of the fact that they also have much at stake, and, through the agencies at their command, are organizing to combat this threat against their employment. Neither railways nor employees are seeking to destroy other forms of transportation, but they are demanding that these newer means of transportation be brought under the same regulation as that to which the railways are subjected, in order that the railways may compete with them on equal terms.

What of 1931?

In facing the new year those railway presidents who have expressed themselves are in general agreement that the volume of traffic will be smaller in the first half of 1931 and larger in the latter half of the new year than in the corresponding months of 1930. Some of them anticipate that the increase in the closing months of 1931 will be sufficient to bring the total for the year above that of 1930. A study of past periods of depression bears out this view, for there has never been such a period that has lasted longer than a year and a half. If past experience affords any guide, a revival of business should be apparent in the very near future and this will speedily be followed by an increase in traffic. This will, in turn, be reflected by increased expenditures for maintenance, for while railway executives are of the opinion that the retrenchment during the latter part of 1930 has as yet caused little deterioration in the properties, they are unitedly of the opinion that such retrenchment cannot be continued much longer without injury.

Indicative of their confidence in what the new year will bring forth, a survey of some twenty railways comprising approximately 25 per cent of the mileage of North America shows that the roads as a whole are planning to spend about $800,000,000 next year for improvements chargeable to capital account, and that of this amount the roads in the United States alone will spend more than $700,000,000, or within 10 per cent of the average of the last 10 years. Such a program is noteworthy by reason of the fact that it marks the continuation of a policy of liberal improvements that has been prosecuted without interruption since the termination of federal control, and with special vigor since 1923. In this period of eight years the railways of the United States alone have spent more than $6,750,000,000 for the enlargement and improvement of their properties or more than one-third as much as in the entire 90 years of railway development preceding 1923.

With facilities far in excess of any demand that may reasonably be expected to be made during the current year, a program of the magnitude of that now contemplated for 1931 shows unquestioned confidence in the future. It also reflects a widespread appreciation of the recognition among railway officers that it is only through expenditures of this character that future economies in operation are to be effected.

Milwaukee Finds Large

Drastic changes in methods of surfacing track after laying new rail expedite the work and reduce the cost

AS a result of economies effected by the Chicago, Milwaukee, St. Paul & Pacific in the laying of rail, which was described on page 380 of the September issue, by substituting a limited number of large gangs organized on a production basis for the smaller but more numerous division rail gangs, it became evident that equally drastic changes could be justified in methods of applying ballast and surfacing the new rail. The methods which have been developed for this latter work are based on the same fundamental idea that underlies this road's recent practice in laying rail, that large gangs completely equipped with power tools and organized on a production basis are not only more economical, but that they can be given more intensive supervision than is practicable when the same number of men are assigned to smaller and more widely scattered gangs, and that for this reason a better quality of work can be accomplished more expeditiously.

In accordance with the plan which has been developed for surfacing all new rail, gangs of sufficient size to keep pace with the rail laying follow closely behind each of the rail gangs to restore the subgrade, apply ballast, renew ties and do the surfacing, completing every item of work as they advance. As soon as they complete the work on any division, they are moved to the next division in the same order as the rail gangs which they follow. As with the rail gangs, they maintain an unbroken organization during the working season and never are assigned to other work. They are placed under the jurisdiction of the division officers on whose territory they are working and report to and receive orders from them the same as if they had been recruited on the division. They are fully equipped with power tools and machines, with a view to eliminating as much hand work as possible.

Cost Has Declined Steadily

Since the present system was adopted in 1927, the cost of this work has declined steadily, until the cost per mile for 1930 is only 81 per cent of that for the first year the plan was effective. Unfortunately, no separate account was kept of the cost of surfacing new rail prior to 1927, so that a comparison with the cost under the old system of smaller extra gangs is not possible. It is certain, however, that the saving is greater than that indicated by the comparison with 1927, owing to the greater efficiency of the larger gangs and their use of power tools and machines.

When the system rail gangs were first organized, in 1926, it was expected that the surfacing of the new rail, the incidental renewal of ties and the application of ballast would be done by extra gangs recruited on the divisions. The rapidity with which the rail was laid under the new system demonstrated very quickly, however, that this practice would not be satisfactory. The situation became the subject of serious study to determine the methods which would give the best results. It was evident at once that the employment of division ballast gangs sufficiently large to keep pace with the progress of the rail gangs would not be practicable for obvious reasons. On the other hand, if dependence was to be placed in extra gangs of the size ordinarily employed on division ballasting projects much of the rail would remain unsurfaced for too long a period and a considerable part of the time of the regular section forces on the territory affected by the rail program would be expended on unproductive labor.

Made a Study of Larger Gangs

These considerations led to a study of the economics of larger gangs for ballasting, patterned after the rail gangs, of sufficient size to maintain approximately the same rate of progress, which could be moved from division to division as the laying of the rail advanced and the surfacing was completed. The final decision to adopt the system of large mobile gangs was based primarily on two considerations. The first was the ability to maintain the organization of the individual gangs intact throughout the working season. The second, a corollary of the first, was that permanent gangs of this character could be provided with suitable mechanical equipment, with the assurance that it would be used intensively for a sufficient period during the year to justify its purchase.

Of nearly, if not equal, importance was the fact that by properly balancing the size of the gangs, the ballasting would advance at the same rate as the laying of the rail, which would reduce to a minimum the time the rail would remain unsurfaced, as well as the time required for completing the rail program on any division. In addi-

Ballast Gangs Economical

An example of the Milwaukee's track after the ballasting gang has completed its work.

tion, such matters as providing camp equipment, recruiting the forces, the delivery of ties, ballast and other materials and supplies, and the shifting of the larger units of equipment, such as ballast plows and shapers, ditchers and locomotive cranes, would be greatly simplified. It has also been demonstrated that this plan permits the preparation of a consistent program for the roads as a whole, which can be carried out under centralized supervision, with the assurance that all rail laid will be surfaced before the season ends, which was not always possible under the former system of smaller division ballast gangs.

This study also indicated, and these conclusions have been confirmed by experience, that where power tools are provided for work of this character, other and larger equipment, such as power jacks, locomotive cranes, ballast shapers, spreader-ditchers, etc., is required in order to keep the entire operation properly balanced. If such equipment is to be used economically, however, it must be used to its capacity at all times, and this is seldom possible with smaller gangs. This, then, was an added reason for deciding on the system of larger ballast gangs.

Preparing the Schedules

Following the preparation of the program and schedules for laying the new and reconditioned rail, a similar program is prepared by the engineer maintenance of way for the ballasting and other work incidental to the surfacing of the rail. Surveys are made during the fall and estimates are prepared of the amount of grading which will be required to restore the subgrade to standard height and width. If these quantities are large, the grading is done well in advance of the delivery of the rail, the shoulders on embankments and the ditches in cuts being roughed in but not finished. This work may be done by a gang or gangs organized especially for this purpose, or it may be done under contract, depending upon the quantities involved and the local conditions. If only a small amount of restoration is required, it may be more economical to allow the ballast gangs to take care of it as a part of the general operation. Care is used, however, to insure that they are not burdened with enough work of this character to impede their progress and cause them to advance more slowly than the rail laying.

Likewise, careful estimates are made of the tie renewals. Since a virtual renewal of the track structure, except ties, takes place, the tie renewals are expected to be fairly liberal, provision being made to replace all ties that will not last more than two years. Levels are run and profiles adopted, from which an estimate is made of the amount of ballast that will be needed.

From the data thus assembled schedules are worked out for every gang, in which are shown the name of the roadmaster in charge, the number of men to be employed, the time and place of starting the work on each division, the expected progress from station to station and the time of completion. These schedules include the estimated number of ties and cubic yards of ballast by miles, the points where ties and other materials are to be shipped and the latest permissible date of arrival. Copies are furnished to the gangs, to the division officers and to the stores department. The stores department makes shipment of ties and other necessary materials in accordance with the schedules and they are unloaded by the gangs upon arrival.

In setting up the organization of the ballast gangs, it was obvious that, owing to the difference in the character of the work, the rate of progress per man would be materially less than could be expected in laying rail. To balance both of these operations, about 460 men are required for the ballasting work. Manifestly a single gang of this size would be unwieldy and difficult to handle. In order to overcome this apparent defect in the plan, the required number of men are organized into two exactly similar gangs which are provided with identical equipment, except the larger units which they share between them.

Adequate Supervision Provided

Each of the gangs is placed in charge of a general foreman. In view of the importance of providing the best type of supervision and of co-ordinating the work of the two gangs, and following the precedent set in organizing the system rail gangs, the entire operation is placed under the jurisdiction of a roadmaster who is without assigned territory and who moves from division to division with the gangs. Two such gangs follow each of the rail gangs, surfacing all of the rail that they lay, progressing substantially at the same rate and completing every item of work as they advance.

Since the organization of all of the gangs on the system, the methods which they employ and the sequence which they follow in their work are similar, a descrip-

tion of one will apply equally to all. The general foremen of the two gangs which constitute each group report directly to the roadmaster in charge of the operation, who also acts as liaison officer with the division officers. The general foremen are held responsible for the character and amount of work they produce and for every item of work, except as specifically mentioned.

Each general foreman has two objectives constantly before him: to maintain the work to the required standard and to produce the maximum amount of work every day. In order that both may be accomplished, ample supervision is provided, foremen and assistant foremen being detailed to handle every part of the work upon which experience has indicated that they can be used to advantage.

Above — The bulldozer breaking down the ballast shoulder. Right— the skeletonizing crew cribbing out the track.

Sequence of the Work

When the restoration of the subgrade requires a minimum amount of work, this feature is taken care of by the ballast gang, as a part of its routine operation. In general, however, the banks are widened, the surface ditches in cuts are cleaned out and drain tile is laid where needed, before the ballast gangs arrive. As a rule the banks and ditches are merely roughed in, since the subsequent operations of the gangs necessitate in any event that considerable attention be given to finishing the subgrade at the time the ballast is dressed.

Preceding the work of the gang, a Jordan spreader-ditcher levels down the shoulder on embankments and removes any excess material from the cuts, thus preparing the subgrade for the disposition of the old ballast. Following the spreader, a bulldozer is employed to cut down the shoulder of the ballast to or slightly below the bottom of the ties and spread it on the shoulder of the subgrade. The spreader, the bulldozer, the locomotive crane which will be mentioned later, and the tie train are all in charge of a foreman who reports directly to the roadmaster, since this equipment is used in common by the two gangs, the roadmaster assigning them to the work from day to day. The general foremen have direct charge of all other parts of the work and the equipment that is used by their own forces.

After the shoulder of the ballast has been broken down, a tie inspector, who is an experienced section or extra-gang foreman, makes a careful surface inspection of all ties, marking them for removal. He also indicates on the far end of each rail in the direction the work is proceeding, the number of ties which will be needed in that panel. The tie train then unloads the ties, distributing them for every rail length as indicated by the inspector's marking, leaving a small surplus from time to time for use in case it develops after the track is skeletonized that additional ties are needed. The force required for unloading the ties, from 12 to 16 men, is taken from the gang which is being served. At other times they are distributed among the various units in accordance with the requirements of the work.

Stripping the Track

The advance unit is the skeletonizing gang, which varies in size from 25 to 40 men, but averages about 33 men. Preceding the cribbing, two men with a specially designed light frame which they lay across the rails for each half rail panel, mark the joint and intermediate tie spacing on both rails. Two men then dig jack holes at appropriate intervals. It has been demonstrated that the work of cribbing can be reduced materially by raising the track carefully and allowing it to drop suddenly, thus loosening the ballast between the ties. The skeletonizing gang digs all of the ballast from between the ties down to the old bed and casts it at random onto the shoulder.

As soon as the tie inspector has completed his surface inspection a sufficient distance in advance to provide for the unloading of all ties on hand, he drops back with the skeletonizing gang to check his preliminary estimate and mark any additional ties for renewal that may be disclosed by the stripping operation. He remains with this gang permanently, except when necessary to go ahead of the tie train to make a preliminary estimate.

Use Locomotive Crane to Advantage

The locomotive crane, which is equipped with a clamshell bucket, follows the spreader-ditcher to dig out accumulations which cannot be handled by the latter at signals, overhead bridges, highway grade crossings, switches and other places where obstructions interfere with its operation. It is also used to coal the work train engines and dig surface ditches when this becomes necessary. This machine follows the stripping gang to dig out at highway crossings and remove the ballast between the main tracks on double track lines and between the main track and passing sidings or other station tracks. On single track, when working in station limits, a specially assigned conductor is in charge of its movements.

Elsewhere, the regular work train conductor is in charge except that it is frequently able to work independently under the flag protection afforded by the work train.

Immediately behind the stripping gang one man removes all anti-creepers and piles them neatly on the shoulder of the subgrade where they can be recovered easily for re-application after the tie renewals and spacing have been completed. Four men with tie tongs then spot the new ties at the points marked for renewals by the tie inspector. Line stakes have been set in advance of the arrival of the gang, and these are checked behind the stripping gang to insure that they have not been disturbed.

Renewing the Ties

Depending on the number of ties to be renewed, the tie renewal gang may vary in size from 80 to 100 men, the normal number of men, including the tie spotters and the man who removes the anti-creepers, averaging about 90. From one to three sets of claw-bar men, each consisting of two men with claw bars and one heeler, pull the spikes in the ties that are to be replaced and in any others where the tie plates are slued. Eight men operating four jacks lift the track to facilitate the removal of the ties, and one man removes the tie plates, while four men with well sharpened picks remove the old ties. Next come six men with sledges who space the remaining ties according to the marks indicating their positions, shifting them so that every new tie will come between two old ones, except in panels where more than half of the ties must be replaced. From four to six men with tie tongs pull in the new ties and one man replaces the tie plates.

Above — The ballast unloaded for raising the track. Right—Raising the track with the power jack.

Six sets of three men each, two spikers and one nipper, spike the line rail, straightening the tie plates, and drive down the spikes in other ties. One gager marks the opposite rail for gaging and one set of claw-bar men pull such spikes as may be necessary. Following this unit, two men insert and drive tie plugs. Two sets of gagers, one nipper and two spikers to a set, gage the rail, the gage being handled by the inside spiker. This unit is followed by six sets of gage spikers, each of which is also provided with a gage. One man re-applies the rail anchors, and six men pick up and pile the old ties for burning. All ties removed from the track are burned at once in order that the entire operation may be completed currently.

If the tie renewals show a tendency to advance more rapidly than the stripping, men are sent to the stripping unit to keep the work properly balanced. On the other hand, late in the day the stripping operation may be retarded to allow the tie renewals to catch up, since it is an explicit rule that no track shall remain open over night. Likewise, for a short time in the morning, a part or all of the tie renewal unit may assist with the stripping to give it a start and allow the tie gang to string out enough for efficient operation.

After the track is full spiked, 1 assistant foreman and 10 men line the track to the stakes. As soon as the old ties are out of the way the bulldozer is used again, this time cutting well below the bottom of the ties and spreading on the shoulder of the subgrade the ballast removed from the cribs as well as that disturbed by the deeper cutting.

Unloading the Ballast

Bank-run gravel, obtained from a pit owned by the company on the Fox river at Spaulding, Ill., is used on all lines in Illinois, Wisconsin and Eastern Iowa. The excellent quality of this material in its natural state makes it suitable for ballast without preparation, as it comes from the pit, and indicates the reason for its wide use.

Ballast for the two gangs visited is handled between the pit and the site of the work in 190 new combination coal and ballast cars of the bottom-dump hopper type, having a capacity of 70 tons or 50 cu. yd. each. The bottom dump doors are specially designed to give full control of the flow of ballast at all times so that the rate of flow can be adjusted to suit the requirements of the profile.

The ballast trains are moved daily to the last district terminal, arriving at this point sometime early in the day, and are scheduled out to arrive at the site of the work at quitting time. The ballast is never unloaded until after the gangs quit for the night and the track is clear of power tools and other work trains. The unloading is done by a picked crew from the gang, consisting of the general foreman and the assistant foremen.

An average of 35 cars of gravel is delivered to each gang daily, although this may be increased or decreased somewhat if the progress of the work demands. The skeletonized track is filled first, the amount to be unloaded being gaged by the grade stakes. The remainder of the ballast is then unloaded back of the surfacing for dressing the track.

The surfacing gang of 39 men, which is in charge of one foreman and two assistant foremen, is equipped with one Nordberg power jack and one Jackson electric tie tamping outfit. In order to speed up the work by avoiding the possibility of dropping the spuds onto ties, two jack-hole diggers precede the Nordberg machine to prepare the jack settings.

When 30-ft. and 33-ft. rails are used, it is customary to make the lifts at the joints and centers, expecting the quarters to come up to true surface. This cannot be done with 39-ft. rails, however, except, perhaps with sections heavier than 110-lb., since the quarters almost invariably sag and fail to come up to the required elevation. For this reason, the lifts are made at the joints of the line rail and at intermediate intervals of 13-ft., or at the one-third points of the rail.

Above—The "chuckers" do the first tamping with shovels. Right—The finishing tamping is done with the electric tamper.

One man tends to the spot board and keeps it in advance of the power jack. One levelman accompanies the track lifter and handles the forward sighting block, while two tampers on each side of the track "catch" the outer ends of the ties to hold the lift to surface. One sledge man on each side shifts any ties that interfere with the dropping of the spuds, while two others, also equipped with sledges, respace these ties and straighten any others that may have shifted after the original spacing was completed.

Method of Raising 39 Ft. Rails

In making the lifts with the power jack, as has been mentioned, the joints on the line rail are lifted. The 13-ft. intervals between the intermediate settings of the jack result in these lifts being made about 6½ ft. on either side of the joint on the opposite rail. Because of the extra weight of the joint fastenings, the joint always sags and must be brought up to true surface. For this reason, an assistant foreman, 1 jackman and 1 tamper are assigned to pick up and tamp this joint.

Following immediately, 12 chuckers shovel-tamp all ties and open up the cribs to permit the most efficient use of the electric tampers. The chuckers work four men to a tie, one at each end and two inside the rail, one inside man and one outside man constituting a pair which keeps several ties in advance of the corresponding pair on the opposite end to avoid interference one with another. The outside man tamps on one side of the tie from the rail to the end, and the inside man tamps the opposite side for a distance of 18 in. inside the rail.

The Jackson electric tie-tamper outfit follows closely behind the chuckers to finish the tamping, the generator unit being pushed along the track as the work advances. This is usually an eight-tool outfit which is organized in the same manner as the chuckers, four men to a tie. Two men are assigned to each tool, and each of them handles it on alternate rail lengths. The tamping is done in the same manner as with the shovels, one tool outside and another inside the rail at each end of the tie, working opposite each other, and for the same distance along its length. In this case, however, the tamping is done on the side of the tie opposite the shovel tamping. Finally, one man follows and shovel tamps the centers of the ties to compact the ballast lightly and prevent the formation of water pockets. One man in charge of a push car follows the surfacing gang to pick up discarded and extra tools.

The average raise ranges from 3½ to 4 in., with a minimum of 2 in., and this is made in a single lift. Experience has demonstrated that with this method of tamping, the track can be brought to final grade in one lift with no more settlement than is usual when two lifts are required.

Giving the Final Line

The final lining of the track is done by the same gang that has done the lining in advance of unloading the ballast. As the weight of the rail increases, the lining of track becomes more difficult, owing to the wider surface of the head. The eye strain is very noticeable after a short time, particularly during periods of bright sunshine, so that the number of trackmen who can do a good job of lining is decreasing. In view of this situation, as well as because of the large amount of lining demanded by one of these gangs, the assistant foreman who is assigned to this work is provided with a Buff and Buff lining transit which facilitates his work and reduces the eye strain.

After the track is lined, ballast is unloaded for dressing the track and the center is plowed out with the bulldozer, but no shaping is attempted at this time. The dressing gang consists of 1 foreman, 1 assistant foreman and 25 men, although this number may be increased to 40 if occasion demands. The center of the track is dressed with shovels and all excess ballast is cast outside. The standard section calls for the ballast to be flush with the top of the tie at the rail, from which it drops 1¼ in. to the end of the tie and continues on this slope to a point 8 in. beyond the ties, where it again drops on a slope of 1½:1. The ballast is dressed by hand to this

latter point, after which the shoulder is formed by the ballast-dressing attachment of the spreader-ditcher. The wings on this machine are dropped to give a final finish to the shoulder and the surface ditches in cuts.

Rate of Progress

To maintain the same rate of progress as is made in laying the rail, it is necessary for each of the ballast gangs to complete approximately one mile of track a day. The maximum amount of work accomplished in any day has been on double track where the traffic was diverted

Above—Lining track with a track-lining transit. Right—The bulldozer plow ahead of the dressing gang.

so that there was no interference from trains. On one day one gang stripped the track, renewed the ties and, using an 8-tool tamping outfit, completed the raise but did no dressing on 9,000 lin. ft. of track. The tie renewals amounted to about 800 to the mile.

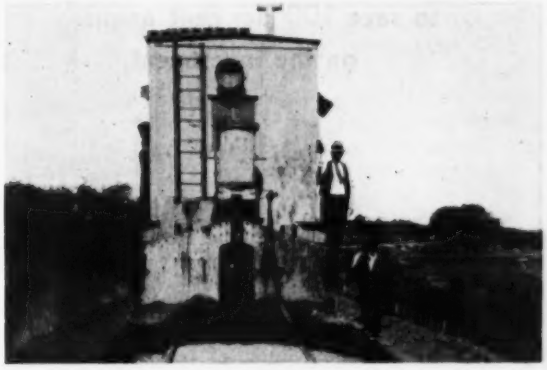
During one week, two gangs working on single track, renewing an average of 700 ties to the mile, completed 15 miles in 6 days. This included the dressing of the ballast, the shaping of the subgrade and the finishing of the surface ditches in cuts. During this time it was necessary to suspend the work and clear the track for the passage of an average of 17 trains daily. The maximum number of trains encountered during the working hours of any day, while working on single track, was 25.

The two gangs of a group do not work together, but may be several stations apart. At any rate they are separated far enough to avoid the necessity of moving them frequently, except as the work of each advances. They may both work in the same direction or toward each other, depending on local conditions. Whatever the arrangement in this respect may be, however, the work of the two gangs is carefully co-ordinated to permit maximum use to be made of the work trains and the larger units of equipment.

Costs Have Been Reduced

Other things being equal, cost is the measure of the efficiency of any operation. Since 1927, when the Milwaukee first tried out the large ballast gangs, there has been a progressive reduction in the cost of labor per mile, as the organization has been perfected, until, in 1930, the cost was only 81 per cent of that for the first year they were used. These figures are based on the cost of a mile of single track where it is necessary to close up for an average of 15 to 17 trains daily. In this connection an interesting comparison has been made of the cost, in 1930, of surfacing a mile of single track where trains interfere and the cost per mile of double track where the traffic is diverted and trains cause no interference. For this year the cost on the double track is only 63 per cent of that for single track, although the tie renewals averaged about 100 more to the mile.

Daily and weekly reports are made for each gang by the roadmaster in charge, showing the number of men employed, the number of hours they are engaged on each item of the work, the number of ties and yards of ballast unloaded and installed and the cost per unit and per mile. These reports are assembled by the engineer maintenance of way who issues weekly, monthly and annual reports showing the relative progress of each gang and its cost of doing each item of the work. This provides a ready reference and a comparison of the relative efficiency of each organization.



The plan for organizing these gangs was developed by W. H. Penfield, engineer maintenance of way, and William Shea, assistant engineer maintenance of way, who also prepare the annual program covering the work of the several gangs. They maintain general supervision over them and issue instructions regarding their activities through the division officers under whom they are working at any time.

Plowing a fire break with a tractor-drawn gang plow.

New York Central Builds

Largest Treating Plant

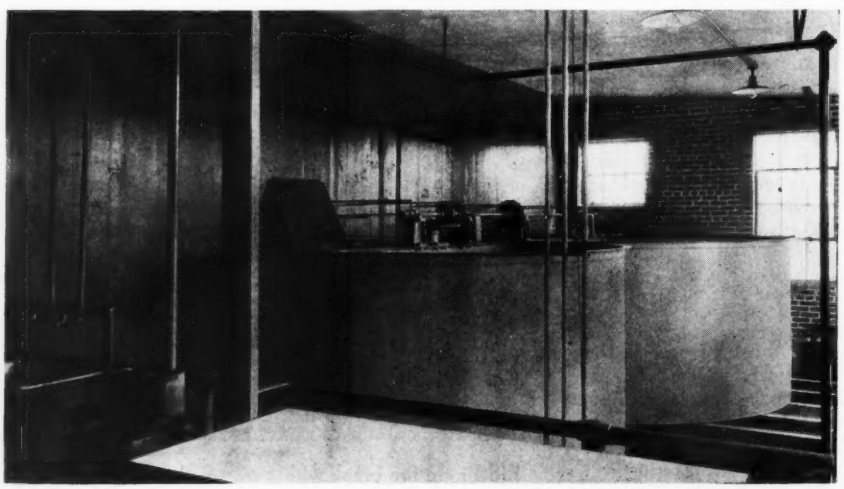
at Elkhart, Ind.

Many refinements in design have been embodied in the new facilities which are designed to save 100 per cent annually on the investment.

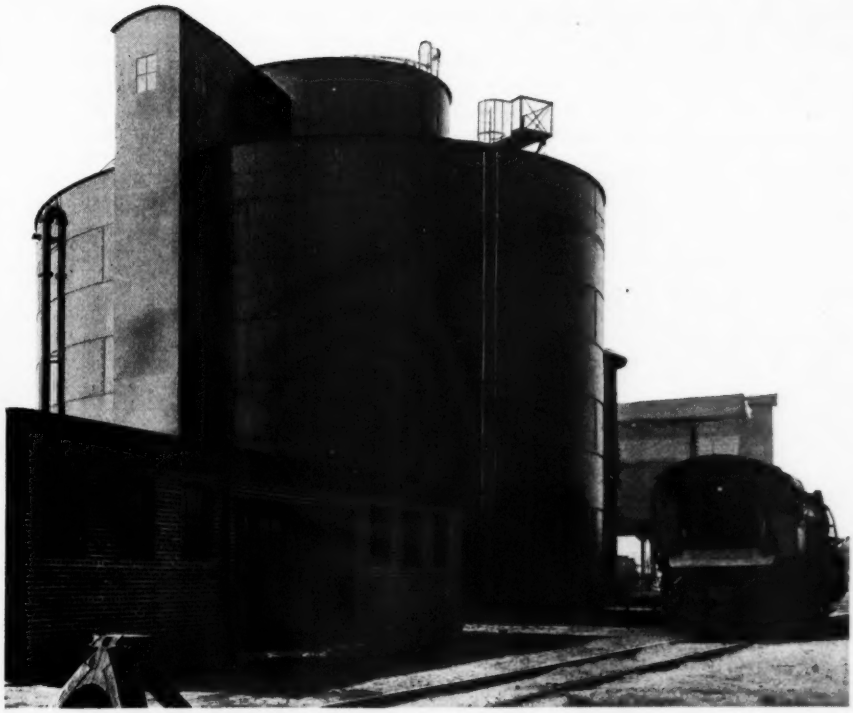
WHAT is believed to be the largest single-unit water-softening plant on any American railway has been placed in service on the New York Central at Elkhart, Ind. It has a treating tank 62 ft. in diameter by 43½ ft. high and has a capacity of 150,000 gal. per hr. Among features of special interest are the use of four downcomers in the treating tank, separate mixing and control facilities for the three reagents, namely lime, soda ash and sodium aluminate, and an arrangement of pipes and valves that permits water to be discharged into the treating tank through the sludge grid for the purpose of agitating the sludge preliminary to blowing it out. Another feature of the sludge discharge is a sight feed by means of which the attendant can look into the discharge line while the sludge is flowing in it. This plant comprises an addition to the existing water-supply facilities at the Elkhart engine terminal and is virtually introduced into the 12-in. discharge line between the pumping plant and the storage tanks.

The natural water obtained from the source of supply at Elkhart, contains from 12.2 to 15.3 grains of hardness per gallon, of which from 3 to 4.5 grains is sulphate hardness. Prior to the installation of the treating plant, scale was formed in the locomotives using this water to a thickness of ⅛ in. to ¼ in. between shoppings. It was estimated that treatment would result in the removal of 755,500 lbs. of scale-forming material per year from the water delivered to locomotives at Elkhart. This would cause a reduction in cost of fuel and boiler maintenance of $98,215 per annum, based on the factor determined by the American Railway Engineering Association, viz. 13 cents per lb. of scale forming material removed.

From this gross saving, deductions were made for the cost of operating the treating plant, including fixed charges on the investment, labor (3 men, 8 hours each) maintenance, electric power, coal for heating, supplies



In the treating-plant house, showing the chemical preparation tanks with the operator's table in the foreground and a tipping meter af the left.



The treating tank of the Elkhart plant is 62 ft. in diameter and 43½ ft. in height.

and chemicals, leaving a net annual saving of over $70,000, or approximately 100 per cent on the investment, which fully justified the appropriation. Operation of the plant since its completion has resulted in a reduction of the hardness of the water to an average of about two grains per gallon.

Description of the Facilities

The treating-plant house is a one-story brick building, 53 ft. long by 43 ft. wide, divided by a longitudinal wall into a chemical storage room and an operating room, with a basement under the operating room that is continuous with a pipe tunnel 8 ft. long that extends to the side of the treating tank. At the opposite end of the working room are two cylindrical tanks 5½ ft. high, one 9½ ft. in diameter for soda ash and the other 14 ft. 3 in. in diameter for lime. These are the chemical preparation tanks and are so placed as to extend part way through the partition between the operating room and the chemical storage room. Thus, the chemicals may be dumped into them without creating dust in the operating room. Gate valves in a 2-in. treated-water supply line permit the required amount of water to be discharged into these tanks for a 12-hr. supply of chemical mixtures when operating at full capacity.

From the bottom of these two tanks 4-in. pipes with gate valves are provided for the discharge of their contents into two square tanks 5½ ft. high occupying the basement directly below them. These are the chemical mixing or supply tanks, the one for soda ash being 8½ ft. square and that for lime being 12 ft. 9 in. square. All four tanks are provided with agitators operated through a train of gears and shafting from a single 7½-hp. motor.

The chemical mixtures in the mixing tanks are discharged through swivel take-off pipes, controlled by separate tipping meters, into two sumps in the basement floor, from which two chemical pumps deliver the lime and soda ash mixtures to the hard-water box at the top of the treating tank through independent 2-in. lines. As these pumps operate continuously as long as raw water is discharging into the hard-water box, it is necessary to insure against the pumps running dry in case the discharge of chemicals from the tanks is interrupted by the tipping meters. This is provided for by having treated water discharge into the sumps under the control of ball float valves, so that any deficiency in chemical mixture is made up by treated water.

At the top of the treating tank, the chemicals and the raw water, which is delivered through a 12-in. pipe, are discharged into a hard-water box, 8 ft. by 6½ ft. by 4 ft. deep, which is divided by diaphragms in such a way that the water must pass through three plates containing closely spaced holes, 1¼ in. in diameter, before pouring over a wier into the mixing box. The hard-water box also contains the two wier pipes which control the tipping meters previously mentioned.

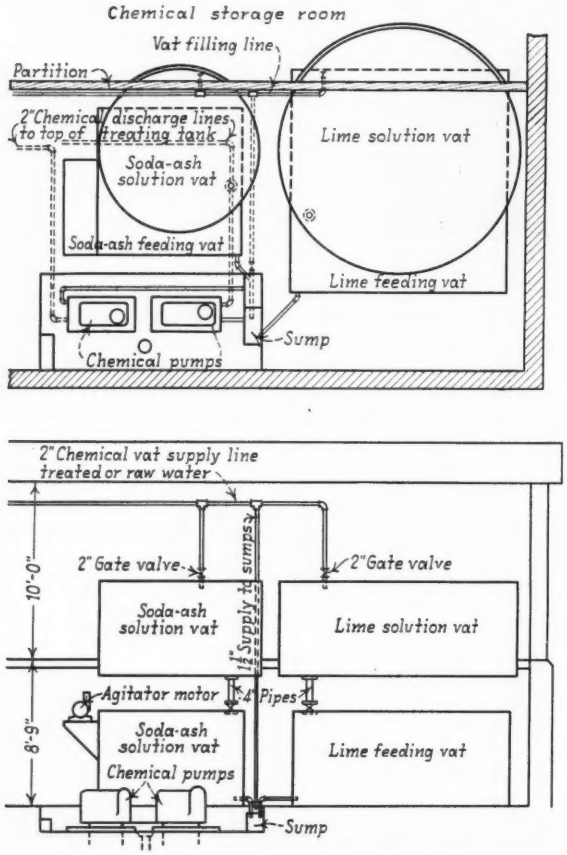
The mixing box is 14 ft. square by 4½ ft. high and controls the delivery of the mixture of chemicals and raw water to the downcomers. It contains an inside box four feet square at the exact center which is equipped with

The chemical supply tanks are located below the preparation tanks.

a motor-operated agitator and from which the water is discharged into the main box through 1¼-in. holes punched in its four-side plates. Before leaving the outer box, the water must again pass through a series of holes in plates placed diagonally across each corner and then discharges over four wiers into flumes leading to the four downcomers.

Construction of the Filter

Four downcomers, each 10 ft. 5 in. in diameter, are provided to equalize the flow. The water, after descending in the downcomers and rising slowly in the main body of the treating tank, passes through an excelsior filter which covers the entire area of the tank three feet below the top. This filter, which is 2½ ft. thick, is supported on a grid of 2-in. by 4-in. joists, in turn held



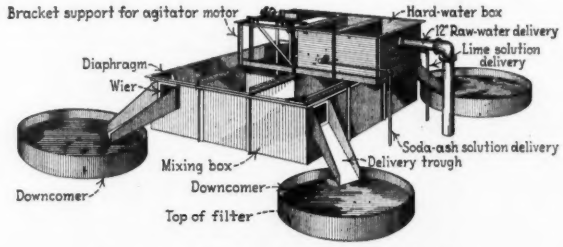
Plan and elevation of the chemical tanks.

up by a frame of I-beams secured to the sides of the tank and the downcomers. It is held down by a grid of 2-in. by 2-in. strips that is tied down to the I-beams by 6-in. by 6-in. binders and bolts.

The filtered water is drawn off through a system of slotted pipes varying from 4 in. to 10 in. in diameter, extending around the sides of the tank and across its center at an elevation one foot above the filter or 1½ ft. below the overflow level. These pipes are connected to a 12-in. vertical discharge line that passes out of the tank through the bottom.

Water level in the treating tank is controlled by a float valve in the raw-water delivery pipe, the opening and closing of this valve also starting and stopping the motor that operates the pump in the pump house as well as the motors operating the two chemical pumps.

To guard against the development of a partial vacuum under the filter when the sludge valves are open, four vents were provided in the form of 6-in. pipes that extend through the filter and to a level six inches above the overflow level of the tank. To avoid having the filter carry the weight of the water above the filter

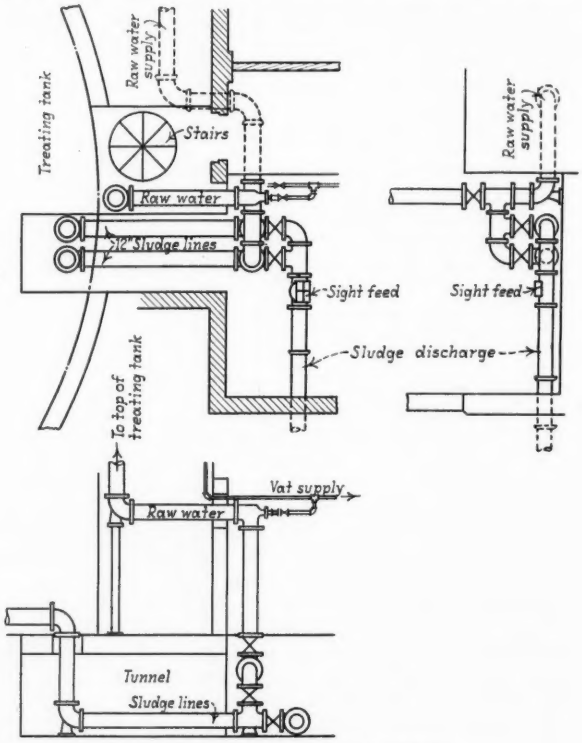


Layout at the top of the treating tank.

level at any time that the water level should be lowered, four counterweighted relief or outlet valves have been provided which will allow the surplus water to drain into the space below the filters.

Welded Sludge Piping

The sludge piping is in two sections, each serving one-half of the tank bottom and discharging through an independent 12-in. main, but which are connected to a common 12-in. waste line outside the tank. Each unit of the sludge piping consists of a main, made up of pipes varying from 3 in. to 12 in. in diameter, to which

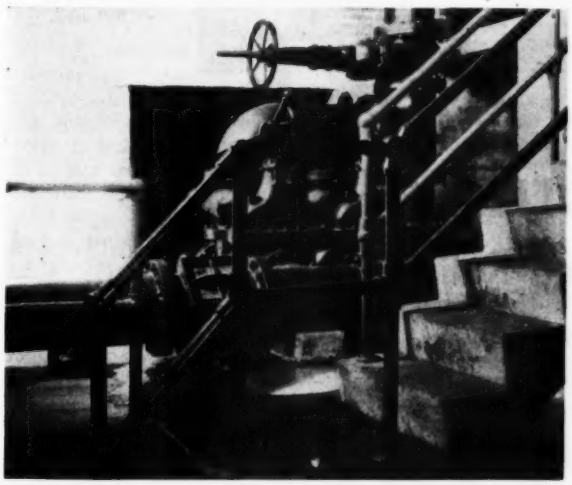


Layout of the sludge control piping.

1½-in. and 2-in. branch pipes were welded at such intervals that it was possible, by drilling holes in the branch pipe, to have the inlet holes spaced uniformly four feet center to center in both directions. The holes are 1⅛ in. in diameter and are located on the underside of the

pipes. Welding was resorted to also in making the changes in the sizes of the main pipe and proved much cheaper than to build a manifold by the use of crosses and nipples or the use of pipe saddles.

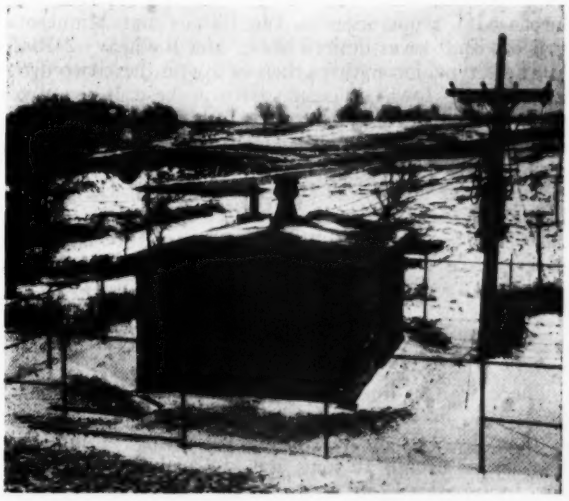
A distinctive feature of the sludge system is the sight feed in the waste pipe near the control valves. This consists of a special flanged fitting having two rectangular openings on opposite sides that are covered with panes of plate glass held in place by metal frames and stud bolts. By looking through one of these windows when an electric light is burning behind the opposite one, it is possible



Showing the sight feed in the sludge line.

for the attendant to observe the turbidity of the discharge and determine when to shut off the sludge valves. The raw-water delivery pipe is interconnected into the sludge pipes so that it is possible to turn raw water into the tank through the sludge grid for the purpose of stirring up the mud before blowing the sludge out.

The plant at Elkhart was designed under the direction of R. O. Rote, chief engineer, H. B. Reinsagen, assistant chief engineer, W. A. McGee, mechanical engineer, and the general supervision of W. L. Curtiss, engineer of water service. The plant was constructed by the Railroad Water & Coal Handling Co., Chicago, under the field supervision of J. E. O'Brien.



A. T. & S. F. pumphouse near Galesburg, Ill.

Use of Snow-Fighting Tools Requires Care*

ONE of the problems in the maintenance of railroads is keeping switches clear of snow and ice. Many railroad yards are equipped with such modern devices as steam coils, gas and electric heaters and oil burners of various types. While all of these devices have proved effective where used they have not replaced snow brooms, scoops and shovels. Snow-fighting equipment is used in the winter months and then only a portion of the time, most of it being used for a day or two during severe storms.

On the Illinois Central in 1929, there were purchased 10,200 snow brooms, 1,416 snow scoops and 3,000 snow shovels, at a cost of $10,888. The annual expense for snow-fighting equipment is due to abuse rather than use. It is used very largely by inexperienced men employed only for the existing emergency. As a result the equipment suffers abuse through ignorance and lack of interest on the part of the users unless they are properly instructed as to its use and care and the instructions followed up and enforced by the foreman or other supervisory officer.

Snow brooms are frequently used to push the snow instead of to sweep it from the tracks and switches. The use of the broom in this manner soon results in a brushy head which renders it unfit for use. The handle end of the broom is usually equipped with a flat metal end for the purpose of chipping away hard snow and ice, but it is not intended to be used as a crowbar for prying away hard chunks of snow and ice; this practice results in many broken handles.

There is also a heavy expense involved in the loss and careless use of snow scoops and shovels. The abuse occurs chiefly when these tools are used to remove hard snow and ice when picks or bars should be employed.

As a rule the greatest loss in snow-fighting equipment is through the failure to take proper care of it. Equipment of this kind is not always checked when issued to gangs during emergencies such as storms or blizzards. Consequently, the fact that there is no record of the tools issued naturally leads to waste. Just as much care should be exercised in checking brooms, shovels and other equipment used in fighting snow as that followed in checking the time worked by the men.

Brooms used in fighting snow are strictly seasonal equipment, and, as previously stated, are used for short periods throughout the winter months. Snow scoops and shovels may, of course, be used for other purposes. Their use, however, is infrequent and far more are required for handling snow than in ordinary track work. This means that snow-fighting equipment is idle for the greater part of the time, and the importance of taking care of it when it is not in use should be carefully observed as the waste is almost equally divided between abuse in actual service and losses when not in use. More careful attention to the details of its use and care will produce marked savings in the annual expense for this equipment.

*Reproduced from an article in the Illinois Central Magazine, which was prepared by C. R. Knowles, superintendent water service of that road.

TEN YEARS AGO—The consolidation of the four express companies into the American Railway Express Company was approved and authorized by the Interstate Commerce Commission on December 20.—*Railway Age*, December 24, 1920.

The Leavenworth bridge of the Chicago Great Western, where welding was first used.

Welding in Bridge Work

Its Economy and Reliability

Bridge and Building Association considers application of electric welding to steel structures

TWO speakers at the convention of the American Railway Bridge and Building Association, which was reported in *Railway Engineering and Maintenance* for November, 1930, page 495, discussed problems relating to the application of electric welding to bridge work, primarily the strengthening of bridges. The reliability of welds was discussed in an address by H. M. Priest, assistant engineer, American Bridge Company, New York, while the practical application of welding in the strengthening of a bridge on the Chicago Great Western was the subject of a paper read by W. R. Roof, bridge engineer of that railway. These two features of the convention were withheld from the report of the convention referred to above and are presented in abstract below. While railway bridge engineers have taken a conservative attitude with respect to the application of the welding process to new bridges, they have shown much interest in its use in strengthening old structures.

How Reliable Are Welds?

In an address on Tuesday evening, H. M. Priest, assistant engineer, American Bridge Company, New York, discussed the reliability of the commercial welding of structural steel. He opened his talk with the question, "What degree of uniformity can one look for from various shops over the country?" Although he discussed welding by both the electric arc and the oxy-acetylene processes he confined his talk largely to the former. Mr. Priest dwelt largely on an investigation that is being made by a committee of the American Welding Society in some 40 shops throughout the country to determine the relative efficiency and uniformity of the work done at these various locations. To date this committee has data concerning the work done by 44 welders in shops located all the way from the Atlantic seaboard to Omaha. The average of all of these tests shows a strength of 8,000 lb. above the figure set in the specifications. He reported further that the work of 28 of these welders and of 65 per cent of the tests made to date are within 5 per cent of this average, and that the maximum variation is less than 10 per cent. These figures were presented to show the high degree of uniformity that can be expected from welding of this character.

Strengthening a Bridge by Arc Welding Process

By W. R. ROOF
Bridge Engineer, Chicago Great Western, Chicago.

THE arc welding process is especially adapted to steel bridge strengthening and repairs where the time element is important, traffic delay must be reduced to a minimum, and expenditures must be limited. Such a situation faced the bridge department of the Chicago Great Western early this spring. New heavy power was purchased for operation on the Illinois and Minnesota divisions and it was desired to transfer the heavy 2-10-2, Santa Fe type, locomotives then in use on these two divisions to the Iowa division. Before these locomotives could be permitted to operate on this division, it was necessary to reinforce the floor system of the bridge over the Des Moines river in Des Moines, Iowa.

This bridge consists of four skew single-track, 180-ft., through-truss spans, designed for Coopers E-42 loading and placed in service in 1902. This structure has been in service 28 years and for the last 20 years it has carried traffic considerably heavier than that provided for in the design.

Stringers Were Overstressed

There are two lines of stringers spaced 6½ ft. apart, 24 ft. 10½ in. long and made up with four angles 6 in. by 6 in. by 9/16 in. and a web 42 in. by ½ in. The floor beams are 16 ft. long and are made up with four 6-in. by 6-in. by ½-in. angles and a web 48 in. by ½-in. The rivets are ⅞ in. in diameter.

Under the loading of the locomotive in question, the flange stress in the stringers was 24,100 lb. per sq. in. and that in the floor beams 27,100 lb. per sq. in., including impact in each case. As only single-headed locomotives will be operated over this structure and at a reduced speed, it was found that reinforcement of the trusses was unnecessary. By welding cover plates to both flanges of the stringers, it was possible to reduce the flange stress to 16,800 lb. per sq. in. and by adding cover plates to both flanges of the intermediate floor beams, the stress was reduced to 17,180 lb. per sq. in.

The arc welding process was selected because it could be carried out on short notice and because plain plates could be obtained more quickly than plates punched for riveting.

The work was done by three welders with three welding machines of the motor-driven type, delivering 85 volts d. c. at 300 amperes. Electrical energy at 440 volts d. c. was available in a transmission line located 150 ft. from the bridge. Nineteen working days or 52 man-days were required to perform the work. The average lineal feet of welding per man for each day was 140. Division forces consisting of three bridge gangs were on hand to assist the welders in placing the new reinforcing plates, cleaning the old steel, shifting the bridge deck, shifting the scaffolding, cutting out rivets in the stringer flanges which interfered with the placing of the new plates and in installing the creosoted blocking under the end floor beams, which were not welded. This required an average of 19 bridge men for a total of 362 man-days.

Downhand welding is preferable to uphand welding as it insures better fusion and greater speed. In order to eliminate uphand welding, the top reinforcing plates were made 3½ in. narrower than the original top flange width and the bottom reinforcing plates were made 2½ in. wider than the original width of the bottom flange. The top plates were ordered ½ in. thick and the bottom plates ⅜ in. to compensate for the difference in width and obtain balanced flange sections. The size of the fillet weld was ⅜ in. throughout the work.

Teh cost of the work was as follows:

(A)	Welding Work:	
	New Plates—47,560 lb.	$ 899.19
	Welding 7,212 lin. ft., lump sum contract	3,170.50
	Company forces assisting	784.50
	Total—Welding work proper	$4,854.19
(B)	Miscellaneous work, consisting of blocking up end floor beams, painting, hardware, store and tool expense, freight and rental of equipment	1,635.51
	Total cost of all work	$6,489.70

A total of 24 floor beams and 56 stringers were reinforced at the top and bottom flanges, requiring 6,645 lin. ft. of downhand welding and 567 lin. ft. of uphand welding, or a total of 7,212 lin. ft. of ⅜-in. arc-welding work. The average cost of the welding work proper was 67.3 cents per lin. ft.

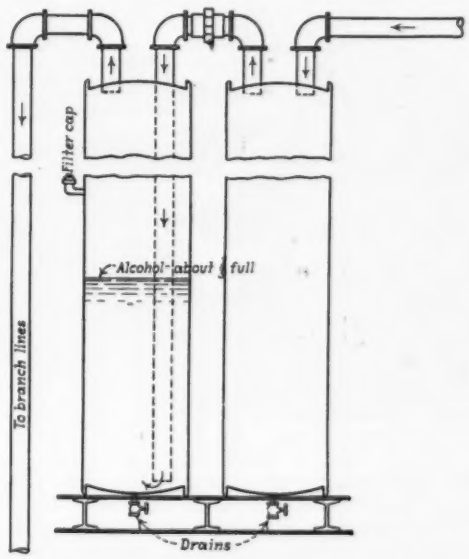
Discussion

In reply to questions, Mr. Roof stated that the cost of welding the reinforcement on this structure was one-third what it would have cost to have attached it by riveting. He added that the work at Des Moines was done with no interference with traffic other than a slow order to protect the workmen who were employed to shift ties out of the way of the welders. Mr. Roof also stated that there had been no indication whatever of failure in the three years that have intervened since a similar bridge across the Missouri river at Leavenworth, Kan., was strengthened in this manner.

How to Prevent Freezing of Air Lines

DURING the freezing weather of winter months a not uncommon obstacle to the efficient operation of compressed-air equipment is the freezing of the air in the lines or in the small ports and valves of the pneumatic devices. In order to overcome this trouble at the maintenance of way shops of the Baltimore & Ohio at Martinsburg, W. Va., where pneumatic equipment is employed extensively in the repair of bridges, buildings and turntables, in the sawing and drilling of rail, and in the loading and unloading of material, a simple and economical method of preventing freezing of the air lines has been developed.

In this method the compressed air is dried and mixed with denatured alcohol as it leaves the shop buildings in the main service lines. The necessary equipment consists of two upright cylindrical tanks situated in each main



A diagramatic sketch of the anti-freeze equipment

service line. One of these is a condensation tank which condenses the moisture in the air, and the other is a mixing tank in which the dry air is mixed thoroughly with denatured alcohol.

The compressed air enters and leaves the condensation tank through two connections at the top. The outgoing dry air passes immediately into the mixing tank, which is about one-third full of denatured alcohol, and is conducted through a pipe to within about one inch of the bottom of the tank, where it is released and allowed to pass up through the alcohol and into the service lines.

It is said that this arrangement is made effective by the passing of the comparatively dry air through the alcohol, thereby causing the agitation and evaporation of the liquid and the impregnation of the air with alcoholic fumes, which prevents the freezing of the air.

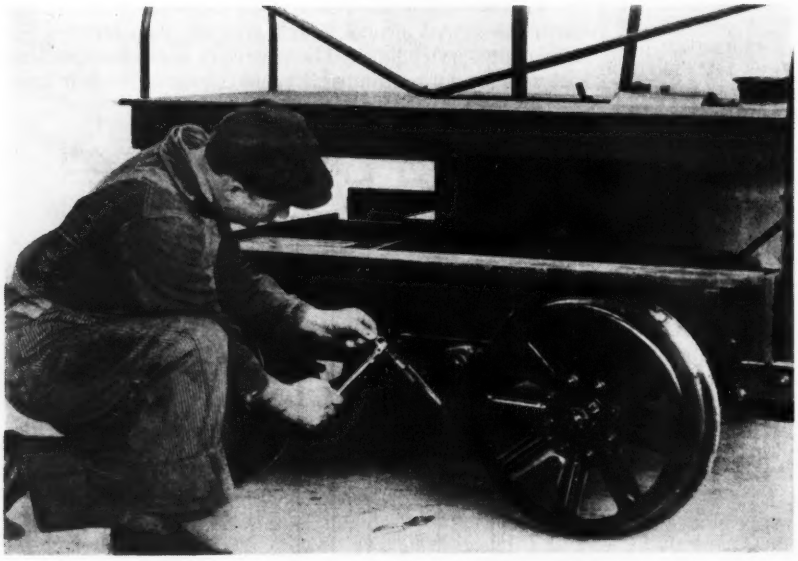
We are indebted for the information contained in this article to S. C. Tanner, superintendent of the maintenance of way shops of the B. & O. at Martinsburg, who developed this method.

How to Keep a Motor Car Running

Part I

Maintaining the ignition and fuel systems, the engine and the transmission *†

By C. R. KNOWLES ‡



Brakes should be inspected frequently and kept in proper adjustment

THE proper maintenance of a motor car is essential to its efficient and economical operation. Regardless of how well built or how efficient a car may be, it is only a question of time until it will require repair, and unless provision is made for timely, efficient maintenance, the results will in all probability be disappointing.

Not all of the railroads have yet developed systematic plans for motor car maintenance, and even on those roads where such measures have been devised they are not always followed in detail. This is particularly true of field maintenance.

Three Classes of Maintenance

The maintenance of motor cars may be divided into three general classes: (1) Running repairs or field maintenance, (2) emergency repairs or breakdowns, (3) heavy repairs or shop maintenance.

Running repairs, or field maintenance, includes all work that can best be done without shipping the car in to the motor car shop or taking it out of service for more than a short period of time, the work being performed by the operator of the car or by a traveling motor-car repairman. As a rule, ordinary breakdowns come under the same classification, the exception being where the breakdown is of such a nature as to necessitate the complete overhauling of the car or engine.

Where motor cars are damaged extensively through collisions, derailments, etc., and where the repair work consists of the renewing of frame members, the straightening of axles, the replacing of broken engine parts, etc., it should not be considered as coming within the scope of field repairs. General overhauling to make good normal wear and breakage also belongs in the shop rather than in the field.

It is difficult to establish any sharp line of demarcation between field maintenance and shop repairs for this depends upon the facilities available in the shop. If this equipment does not consist of other than small tools there is no reason for sending a car to the shop for repairs.

Good motor-car operation includes field maintenance, for the proper operation of the car carries with it minor details of every-day maintenance that prevent breakdowns and delays, increase the efficiency of the car and greatly lengthen the periods between shopping for general repairs. Certain features of maintenance are so closely allied with operation that it is difficult to draw a definite line of demarcation. Among these details are proper lubrication, frequent inspection, the adjustment of moving parts, the tightening of loose bolts and nuts and,

*This is the twelfth of a series of 15 or more articles on the Care and Operation of Motor Cars, the first of which, on the Place of the Motor Car in Railway Work, appeared in the January, 1930, issue, page 5; the second on the Type of Motor Car, in the February issue, page 54; the third, on the Motor Car Engine, in the April issue, page 158; the fourth, on How a Motor Car Is Built, in the May issue, page 214; the fifth, on Proper Lubrication, in the June issue, page 248; the sixth, on Ignition, in the July issue, page 295; the seventh, on the Care of Motor Cars, in the August issue, page 339; the eighth, on How to Secure Efficient Operation from a Motor Car, in the September issue, page 376; the ninth, on Motor Car Accidents, in the October issue, page 416; the tenth, on Motor Car Accidents, in the November issue, page 482; and the eleventh, on Operating Motor Cars Safely, in the December issue, page 546.

‡Mr. Knowles is in charge of the operation and maintenance of motor cars and other gasoline-operated work equipment on the Illinois Central System.

last but not least, intelligent care of the car, thereby forestalling or eliminating the necessity for repairs. The operator of a motor car should have sufficient knowledge of the construction of the car and sufficient mechanical ability to make minor repairs and adjustments as needed, not only to reduce the cost of maintenance but even more to avoid keeping the car out of service until the repairman arrives.

Depends on Manner of Operation

The amount of work that may be done in the field depends almost altogether on the manner in which the car is operated. If it were not for the abuse of cars in operation and the damage resulting from accidents, there would be practically no reason for maintaining motor-car shops, for there are many records of motor cars that have been maintained in service throughout their useful life, which is estimated to be from 8 to 10 years. On the contrary, however, records of the majority of the cars in use show very short periods between shoppings.

There does not appear to be any good reason why motor cars could not be placed on a mileage basis and a predetermined mileage fixed for each car between shoppings, if provisions were made for their proper care in the field. No one would expect a locomotive to run from one shopping to the next and produce the desired mileage without any attention other than to supply fuel and water and to oil it occasionally; yet too often a motor car is handled in that manner. The inevitable result is that the motor car does not give the continuity of service that it should. It is less efficient in operation when on the track, and is in the shop for repairs when it should be in service.

A motor car should be considered as an investment upon which a definite return is to be expected. If the correct return is to be realized the car must be properly maintained. Aside from the cost of owning a motor car, there is the expense incurred when the gang to which it is assigned has to walk to and from its work. This may represent an additional expense of $5 or $6, or more, for every day the car is out of service.

Work That Should Be Done By Operator

It is impossible to draw a definite line of demarcation between the repairs that should be made by the motor-car operator and those requiring the attention of a motor-car repairman for this depends very largely upon the ability of the operator. All motor-car operators do not have the same mechanical ability. Some have difficulty in making the most trivial repairs to motor cars, as for example the renewal of spark plugs or batteries, while others are fully qualified to make any repairs that might be made by a regular motor-car maintainer. For example, signal maintainers and water service repairmen usually have sufficient mechanical ability to take care of all field maintenance. It will be found, however, that the majority of motor-car operators are able to handle only the minor details of maintenance, and skilled repairmen in both field and shop are essential to the efficient and economical maintenance and operation of the cars.

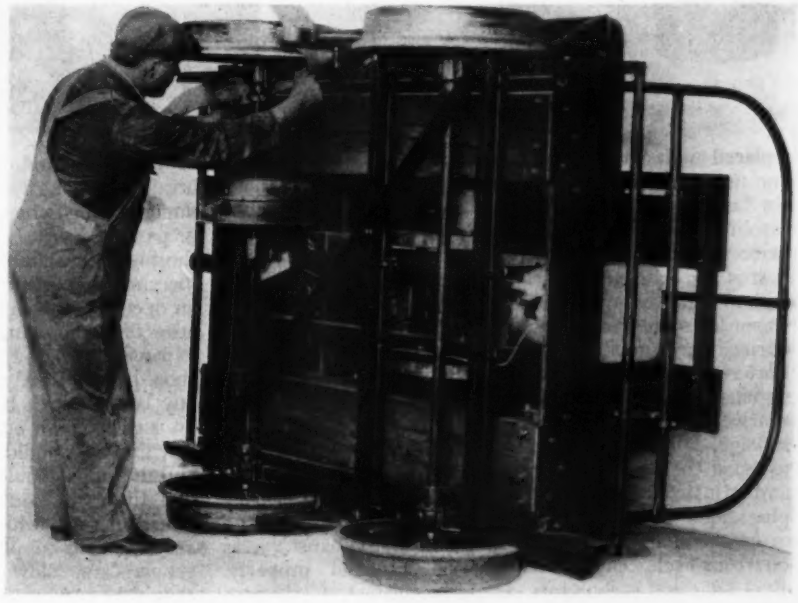
Every operator of a motor car should be able to make such minor repairs and adjustments as are necessary for the proper maintenance of the fuel and ignition system if efficient operation is to be secured from the car. Fuel and ignition troubles, which are largely responsible for the failure of motor cars in the field, are due to any one or more of the following causes: (1) Weak battery; (2) failure of the fuel supply or water in the gasoline; (3) fuel lines obstructed or shut off; (4) loose or defective wiring; (5) spark-plug points corroded or improperly set; (6) poor gaskets on manifolds causing leaks; (7) defective spark coil; (8) improper timing; (9) too lean or too rich a mixture.

The Battery

The battery should be tested by the operator at regular intervals and exhausted or defective cells renewed. Care should be used when installing a new battery to place the cells in the battery box so that the terminals will not come in contact with other cells or with the sides of the box. They should be wedged firmly in the box, with either split blocks or with dry paper or waste to prevent any movement through the vibration of the car which might wear or cut the paper covering of the cells or permit the terminals to contact, thus causing short circuits.

Repairs or adjustments to the magnetos should be made by a skilled mechanic who is familiar with their construction and operation. As a rule, the best way to take care of a magneto is to leave it alone as most magneto failures are due to their being tampered with.

The operator should use care in renewing spark plugs. They should not be screwed too tightly in the cylinder, particularly if it is hot. A socket wrench or an end wrench of the right size should be used as pliers, pipe wrenches or large monkey wrenches frequently damage



Belts can be replaced readily in the field but much trouble and damage to belts can be avoided by exercising proper care in applying them

spark plugs. To clean a plug, remove it from the cylinder and clean it with a cloth or waste. Scrape hard deposits from the porcelain with a knife; do not use sand paper or emery cloth on the porcelain as it may destroy the glaze, permitting it to absorb oil or dirt, and cause short circuiting.

If the plugs are taken apart for cleaning, care should be used in reassembling them, screwing the parts together tightly, so that the porcelain is firmly and tightly seated on the gasket, to avoid loss of compression and damage to the porcelain and ground wires. Leakage of compression can sometimes be prevented and the life of plugs increased by simply replacing old gaskets with new ones.

In replacing or repairing the wiring system, only insulated wire should be used and it should be of the proper size and kind for the purpose required. Where the insulation may be worn off or it is necessary to splice the wires, they should be wound with tape. The wire connections to batteries, magneto, spark coil, switches, timer and spark plug should have good contacts. Pliers should be used to tighten the nuts on all binding posts except on the spark coil where they will break the small wires inside the coil box.

The Fuel System

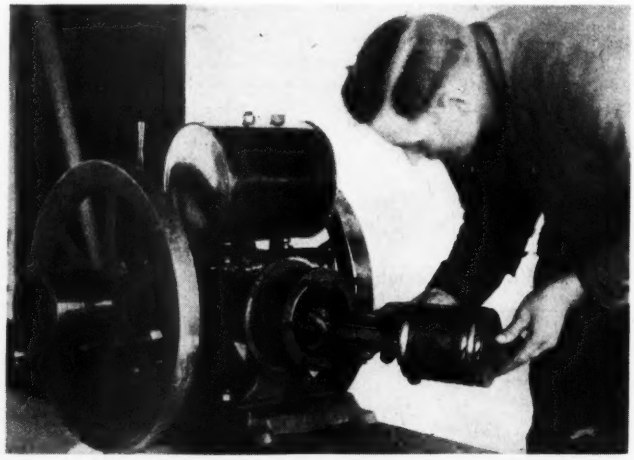
Gas tanks and fuel lines should be inspected frequently to insure against leaks. Leaks in fuel lines can usually be corrected by tightening the connections with pliers or a small wrench. In the event that a fuel line breaks, it can be repaired temporarily by soldering but should be replaced with a new fuel line as soon as possible. Gasoline tanks can also be repaired by soldering in the field but before putting a flame to the tank or fuel lines, all gasoline should be drained out and the tank filled at least twice with hot water to drive out the gas fumes.

It is a good idea to check over carefully and adjust the fuel and ignition system immediately preceding the winter season as more care must be used with fuel and ignition during the winter months to insure proper operation. Batteries should be tested and all cells removed that register below 10 amperes. Defective wiring should be renewed or repaired. Spark coils should be tested for leakage, defective points renewed and the tension adjusted to equal the battery current. Timers should be inspected and adjusted so that the proper contact is secured. Spark plugs should be adjusted to the proper gap and any broken or cracked porcelains renewed. Intake and exhaust valves on four-cycle engines should be adjusted properly. Fuel lines and carburetors should be cleaned. Gaskets of manifolds and carburetors should be examined carefully and any defective gaskets renewed, making sure that the carburetor and manifold connections do not leak. The side or main bearings of two-cycle engines should be examined carefully and packing renewed if necessary to guard against leakage.

The operator should inspect the car at regular intervals, preferably at least once a week, at which time the car should be turned on its side and a thorough inspection made of all parts, giving particular attention to wheels and axles. Wheels with badly worn treads and flanges should be renewed; all wheels except the loose wheels should be tight on the axle. The loose wheels should fit snugly on the axle without any lateral motion. The wheels should also run true and in line. Axles should be examined to see that they run true and are not sprung or bent. Thrust collars should fit up snugly against the bearing box. The axle should fit properly in the bearing. Brakes and brake bands should be thoroughly inspected and necessary repairs made promptly.

Repairs and adjustments to such bearing parts of engines as are provided with means of taking up the wear may be made in the field quite as readily as in the shop. Loss of compression between the cylinder and the piston, resulting from wear, is governed by three or more cylinder rings fitted into grooves in the piston. Broken rings, or rings that are worn to such an extent that loss of compression occurs, may be readily replaced in the field. While their application is comparatively simple this task requires a certain amount of care as the rings are made of cast iron and must be handled carefully to avoid breaking them. Thin strips of metal should be inserted under a ring when removing it from the ring grooves or passing it by a groove. Before placing a new ring on the piston it should be fitted in the cylinder to see that the ends do not come tightly together as there should be an opening of about 0.02 in. or approximately the thickness of a shipping tag between the ends to provide expansion when the engine is hot. The piston rings should move freely in the grooves but should not have any lateral play. If the old rings stick, kerosene should be used to wash out the grooves until they move freely. The grooves should be cleaned before applying new rings, and the rings should be tried in the grooves to make sure that they will not stick or have too much lateral play.

Piston rings which pass the ports in the cylinder wall are dowelled to place so that they cannot turn in the grooves and allow the ends to catch in the ports. Care should be used to have the rings properly located on the



The removal of the piston for the renewal of piston rings is not a difficult task for a man who knows how. At the left—Thin metal strips used to slide piston rings into place.

dowell pins. Old rings, if used again, should always be replaced in the grooves from which they were removed. A liberal amount of cylinder oil should always be applied to the piston and rings before inserting them in the cylinder. There will be a certain loss of compression when new rings are first applied to an old cylinder, owing to the wear in the cylinder, but they will soon become adjusted if properly applied and the wear is not too great. Rings and dowell pins in bad condition should be replaced immediately as they may catch in the ports and score the cylinder and piston.

Another trouble results from the formation in the cylinders of carbon after long service or through improper lubrication. The carbon can be removed readily in the field by taking the engine apart and scraping it out, using care not to score any bearing surface. Carbon will form on the inside of the cylinder head, on the end of the piston, in the ports and around the valves of four-cycle engines and will sometimes cause the piston rings to stick in the grooves. Care must be used to maintain valves of four-cycle engines in proper condition to prevent leakage, for this causes poor operation and possibly permanent damage to valves and seats.

Grinding the Valves

The valves of four-cycle engines sometimes require regrinding to overcome leakage, which causes loss of compression. This can be done by removing the springs and regrinding the seat with oil and flour emery or any other standard grinding compound. Coarse emery should never be used as it scratches the seat and valve. To regrind the seat, the valve should be rotated in alternate directions, a very slight pressure being exerted, lifting the valve off the seat occasionally and turning it slightly in order to distribute the grinding compound and to change the relative position of the valve and seat. The grinding should be continued until the face of the valve and the seat show bright, clean surfaces. The exhaust valves require regrinding more frequently than the inlet valves. The valve and seat should be cleaned carefully after grinding, all grinding compound being washed away with gasoline. Care should be used in removing the cylinder head to avoid damaging the cylinder head gasket or the bolts holding it in place. When replacing the cylinder head, one should be sure that all gaskets are in place and all joints tight. The bolts must be tightened uniformly all around to avoid cramping the head and to insure tight joints.

Connecting rod bearings should be examined as soon as any knock occurs in the engine as neglect may result in the destruction of the engine. If the crank pin bearings are loose they may be adjusted by removing part of the shims between the two halves of the bearing. Care should be used to avoid making the bearing too tight as the friction will burn it out. If the knock is in the piston end of the connecting rod it can be corrected by replacing the bushing in the piston end, the piston pin or both. As a rule the bushing will be worn instead of the pin. This requires the removal of the piston and the piston pin. Care should be used in replacing the pin in the piston to see that it is firmly secured, to prevent the pin from coming loose and scoring the cylinder wall.

The Transmission

Repairs to all types of motor car transmission, on both direct-drive cars and those with free-running engines, can be made in the field. The removal of the crank shaft or driving axle of the car requires considerable skill, and when transmission repairs involve either the crank shaft or the driving axle or both, the work should be done by a competent repairman in the field or in the shop.

Repairs to transmission ordinarily consist of the replacement of chains, sprockets, pulleys and belts, more rarely of clutch linings and fiber fillers on friction drives, and, in very rare cases, of the entire transmission assembly. With ordinary care, however, the transmission will run from shopping to shopping with the replacement of minor parts and minor adjustments.

It is seldom necessary to replace a chain in the field if it is properly cared for, although it is sometimes desirable to shorten the chain in order to take up the wear on chain and sprocket. This can be done very easily by removing one or more links. Many chain-drive cars are so constructed that the chain may be adjusted by changing the position of the axle boxes.

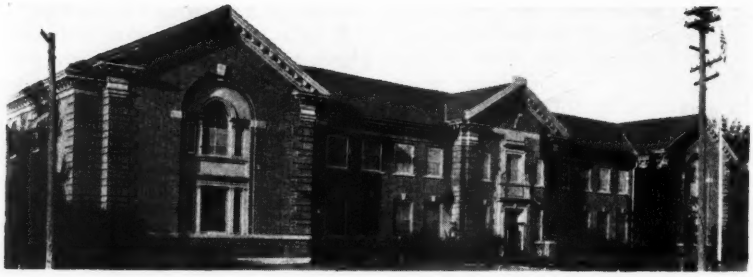
Sprockets wear more rapidly than the chain and therefore require renewing more frequently. When sprockets are renewed, the chain should be checked carefully for pitch, and if it has stretched appreciably the chain should be renewed, as well as the sprocket, because a worn chain will ruin a new set of sprockets very quickly. It is a comparatively simple matter to replace the sprocket on the crank shaft or on the spline or countershaft, but it is more difficult to apply one to the drive axle as this necessitates taking the axle out and removing one of the wheels, except where a split sprocket is used. This work should either be done in the shop or, if in the field, by a skilled repairman.

Pulleys rarely wear out and their renewal is necessary only when they are broken or otherwise damaged through abuse. Their application is comparatively simple as the driving pulley is keyed to the crank shaft and may be replaced by simply removing the key. A certain amount of care is required to see that the key fits properly and is not driven in so tight as to burst the pulley. The axle pulley is constructed in two halves and bolted on the drive axle and can be replaced without taking the axle out of the car. Care should, of course, be exercised when applying new pulleys to see that they are in proper line.

The repair and replacement of belts can also be made in the field by the operator. The weakest point in a belt is the place where the two ends are joined, and too much care cannot be used in making the joint properly. There are many devices for joining the ends of belts, including the lace leather sewn joint and an almost endless variety of metal fastenings. Those used on motor-car belts are chiefly rawhide and wire lacing and a metal fastening called an alligator belt fastener.

Much trouble and damage to belts can be avoided by using proper care in applying them. The ends should always be cut square and must fit evenly. Where wire or rawhide lacing is used the holes in the belt ends should be as small as possible and far enough from the end to avoid their tearing out. The holes should be made by a punch or other tool that will cut a clear hole. If patent fasteners are used, they should be the correct size for the diameter of the pulley and the thickness of the belt.

Endless belts are used extensively on motor cars and while they eliminate much of the trouble experienced with belt fastenings, their renewal usually requires the removal of the drive axle. On other more modern types of cars the application of endless belts requires only the removal of four to six bolts to loosen the axle bearing from the side sill of the car, after which the belt can be slipped under the bearing and out over the wheel to remove it, the application of the new belt being in reverse order. On other cars with countershafts and combination belt and gear drives, the belt may be slipped on and off the pulleys without loosening any part of the car.



The Forest Products Laboratory, Madison, Wis.

Tests Indicate the Suitability of Woods for Crossties

By L. J. MARKWARDT
Senior Engineer, Forest Products Laboratory, Forest Service,
U. S. Department of Agriculture

THE numerous species of wood found in the United States embrace a wide range of properties. With very few exceptions, practically every commercial species is of some value for crossties, but the wide range in properties greatly affects their relative value.

Among the properties of importance in crossties are strength and resistance to decay. Some woods are naturally decay resistant, which is obviously a decided advantage, but deficiency in this respect can be overcome by preservative treatment. The fact that durability is controllable within certain limits makes the strength properties of chief importance. It is the purpose of this article to present data on the comparative strength properties of woods from the standpoint of their use as crossties.

Standard Mechanical Tests

The Forest Products Laboratory, in its studies of wood, has made standard mechanical tests on small, clear specimens of 164 of our native species. Winslow and Newlin in 1916 presented a method of classifying the data on different mechanical properties from these tests so as to obtain a single tie strength figure for each species, which represents an index of its suitability for ties, in so far as suitability from the strength standpoint can be expressed by a single figure. Three factors were considered of special importance in appraising the mechanical suitability of wood for crossties: (1) Its bending strength or ability to resist center or end binding; (2) its end hardness and strength in compression parallel to the grain, which are indicative of its resistance to spike pulling, and the lateral thrust of spikes; and (3) its side hardness and compression perpendicular to grain, which indicate the ability to resist rail or plate wear. Data on all these properties are reflected in the "composite tie strength figure" which was arrived at.

The table presents composite tie strength figures for a large number of our native species and in addition gives average values for specific gravity, compression perpendicular to grain, and side hardness. In the table, the species are listed alphabetically. The composite tie figures reflect the values on both green and dry material and are calculated from comprehensive data which were recently presented in United States Department of Agriculture Technical Bulletin 158, entitled "Comparative Strength Properties of Woods Grown in the United States." The values for compression perpendicular to the grain and side hardness are for green material.

The Table Gives Averages

The data presented in the table are averages. In this connection, the figures for the less important species, which are based on fewer tests, are more subject to change subsequent to additional testing than those for the more common species.

The part of the tree from which the ties are produced is sometimes important as affecting the strength properties. The data presented are representative of material from the lower log. In most species, ties cut from the tops of the logs are lighter and softer than those taken from lower in the tree.

Although the serviceability of any wood for ties is dependent on its mechanical properties, some properties and combinations of properties are often brought into play on which no adequate data are available. Furthermore, the relative importance of the several mechanical properties involves changes with conditions of track installation and maintenance, and, especially with service conditions.

Therefore, it is evident that the values presented in the table do not necessarily give a final measure of the exact suitability of the species for crossties, but should rather be regarded as indicative of their utility. Service records, when available, are of great value in appraising the relative behavior of woods under any given set of conditions, and sometimes show that species with a fairly

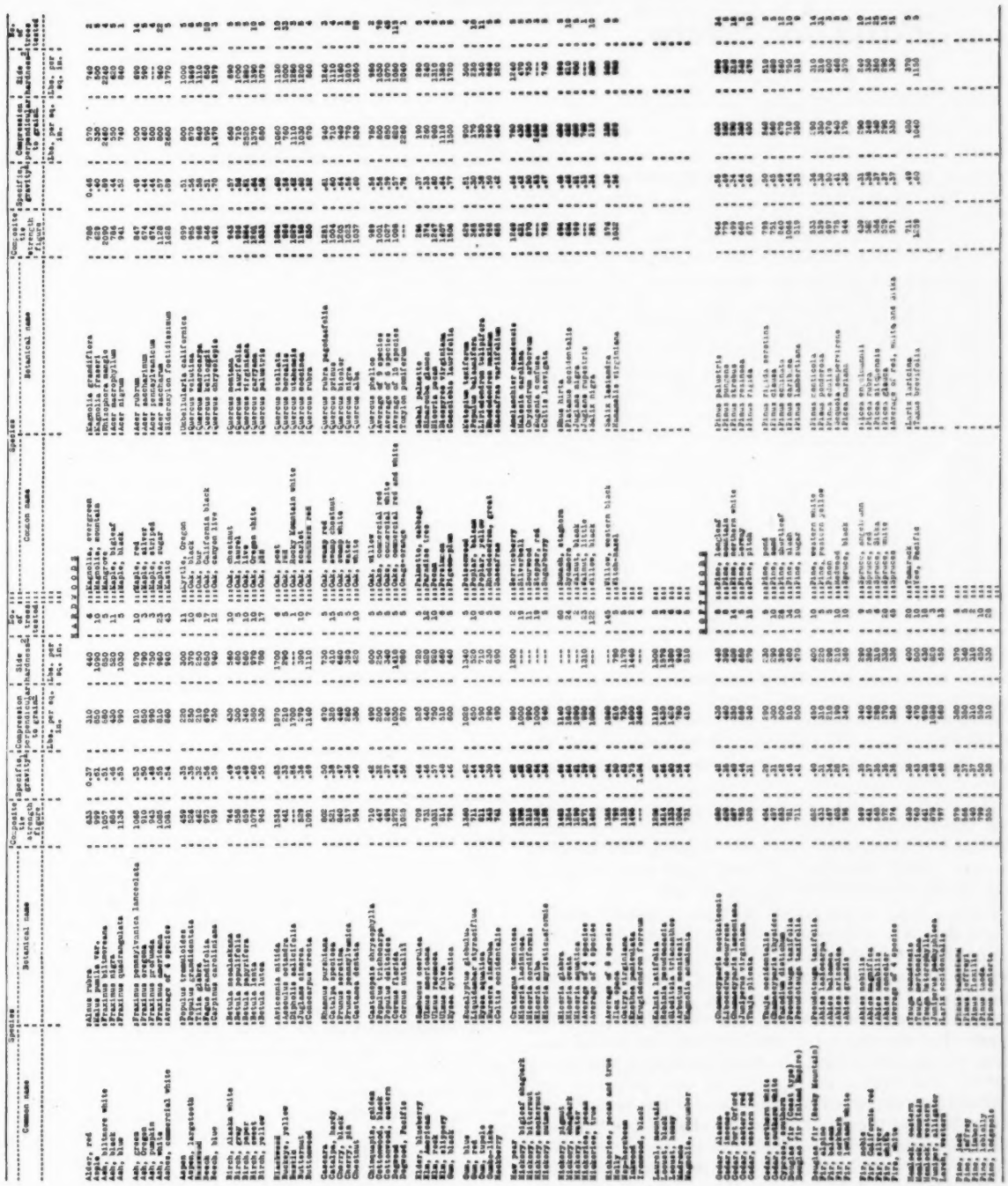


Table of properties of woods used in crossties

low composite tie-strength figure may surpass one of higher rating.

Studies have shown that there is a relation between specific gravity and the various strength properties of wood, the densest material having the highest strength. This relationship holds in general among the different species, as may be observed from an examination of the data in the table, and also between individual pieces of the same species. Hence the specific gravity gives a good indication of the ability of wood to resist wear and to meet the other strength requirements of crossties. In the absence of actual tests, specific gravity determinations are recommended as a ready method of roughly determining the relative strength values of any given species.

FIFTY YEARS AGO—The Washington City, Virginia Midland & Great Southern was sold at Alexandria, Va., on December 20, the sale subject to certain leases and contracts, one of which is a lease of the line between Strasburg, Va., and Harrisonburg to the Baltimore & Ohio. The main line of the road extends between Alexandria, Va., and Danville, 242 miles.—*Railroad Gazette*, December 24, 1880.

Prizes for Safety*

BY B. S. HOLLIMON

Division Superintendent, Southern Pacific Lines, Ennis, Texas

THE safety record of the maintenance of way department of the Southern Pacific Lines in Texas and Louisiana has improved gradually since the Bureau of Safety was organized in 1918, until the number of reportable accidents is such that it is pointed to with pride. The success thus far attained has been the direct result of the education of officers and employees in safety, through supervision, rewards, judgment in the selection of employees and the provision of proper tools and safety devices. Accident statistics have been maintained accurately since the bureau was organized and are as follows:

Reportable Casualties in Track and Bridge and Building Service —Southern Pacific Lines in Texas and Louisiana—

1918 to 1929, Inclusive

	Trackmen	Bridge and Building Men
1918	306	59
1919	293	42
1920	495	65
1921	364	57
1922	345	101
1923	336	73
1924	222	51
1925	170	48
1926	140	36
1927	179	42
1928	137	34
1929	133	22

Up to the period when the safety of employees became a part of our operating detail, reports and investigations of accidents did not always receive the same character of surveillance as they did following the organization of the safety department in 1912. These investigations became more exacting after 1918, and today all accidents which result in injury or the hazard of injury, are given complete supervisory investigation to determine the facts, effect and responsibility. Reports are required of even the most trivial accidents, a very large proportion of which include no disability or loss of time.

When a man is employed, we may consider him as being a desirable employee from a safety standpoint only in proportion to the amount of safety education he has absorbed from other employment or through personal experience. The duty of educating this man devolves upon his superior officers and fellow employees, and to the end that this employee shall receive this safety education, we have broadcast the safety program, instructed foremen and employees in caution, safe practices and methods, and exercised diligent care in the selection of men, until now the employees and officers are working enthusiastically and harmoniously in this movement. The same principles and precepts that are applied in other departments, intended to lead to the avoidance of injury, apply equally well to the maintenance of way department, and unless there is a full realization that all departments are interlocking in this respect, the best results cannot be expected. We find that our maintenance of way foremen show as much interest in the results obtained in other departments as they do in their own, and for their benefit they are given a monthly statement, subdivided by departments, showing the accidents, reportable and otherwise, for comparative purposes.

The states through which the Southern Pacific operates depend largely on Mexican and negro labor, and the close proximity to Mexico results in large numbers of laborers from that republic making railroad section work their vocation. The Mexican is not, generally, a settled worker like the negro, but is satisfactory if properly selected, trained and cared for. Foremen are under instructions to exercise care in the employment of men, selecting only those who appear to be in good physical condition and under 45 years of age, preference being given to younger men. Good housing conditions at sections and in floating gangs have resulted in reducing the labor turnover, thus retaining men experienced in their work and consequently more desirable from a safety standpoint. All of the privileges, such as annual passes, pension, insurance, etc., are accorded this class the same as other grades and we have on my division many who have from five to ten or more years of continuous service.

Some years back, motor-car accidents were the rule rather than the exception, but since a code of motor-car rules was issued and vigorously enforced, the situation has been reversed. These rules are concise and cover motor-car operation in a thorough manner, and are posted in tool houses and other appropriate locations for the information and guidance of employees. The rules are specific as to motor-car operation, and, in addition, a thorough knowledge of all operating rules is required of foremen, who are reprimanded or disciplined for infractions, regardless of whether it resulted in injury to men in their charge. If it were possible to secure complete compliance with the operating, maintenance and motor-car rules in their entirety, we would practically eliminate accidents resulting from the use of motor cars. Discipline has been found to secure a quicker and better reaction in this respect than any other method.

Prizes for "No-Accident" Records

Rewards for good safety records have also been awarded to keep foremen and supervisors interested in the safety program, and the response secured through this means has been very good. An annual record is maintained of man-hours worked by gangs under each foreman and supervisor and a reward is given at the end of each year. Foremen of all gangs in the maintenance of way department are eligible to receive a reward. This annual reward system was inaugurated in 1925 and since that time the Southern Pacific Lines in Texas and Louisiana have paid out an average of some $18,000 per annum to foremen and supervisors in both the maintenance of way and mechanical departments.

A minimum prize of $15 is awarded to the foremen in charge of gangs working 20,000 man-hours or less during the year without having a single reportable accident. For foremen in charge of larger gangs, the prizes are increased at the rate of $15 for each additional 40,000 man-hours worked without a reportable accident up to a maximum of $105. However, regardless of the size of the gang, foremen having three or more reportable accidents are not eligible for any prize. A reportable accident is defined as one where an employee is so seriously injured as to be incapacitated from performing his ordinary duties for more than three days in the aggregate during the 10 days immediately following the accident. Assistant foremen of maintenance of way gangs are each awarded a prize equal to one-third the amount of the prize won by the foreman under whom they work.

After the usual safeguards in the way of proper tools, safe motor cars and machines have been taken care of and discipline and rewards administered, where merited, the prime factor in all safety work is consistent and considerate supervision, which is necessary to avoid those accidents resulting from other causes and chargeable to personal carelessness.

*Abstract of an address presented before the annual meeting of the Safety Section, American Railway Association, at Denver, Colo.

Railroads Announce Track Awards

SUPPLEMENTING the report of the track awards on the Pennsylvania following the annual track inspection, which was presented on page 551 of the December issue, we give below the results of the inspections on the Pere Marquette, the Chesapeake & Ohio, the Erie, the Norfolk & Western, the Lehigh Valley, the New York Central, the Canadian Pacific and the Southern.

Prizes on the Pere Marquette

For the sixth time in eight years the first prize of $100, which is awarded by the Pere Marquette to the supervisor's territory showing the highest percentage rating, was awarded this year to William O'Brien, supervisor on the Toledo division, whose territory extends south of Holly, Mich. The other prize of $100 for the supervisor's territory showing the greatest gain in percentage rating over the previous year was won by N. Jorgensen, supervisor on the Muskegon division, whose territory extends between Holland, Mich., and Muskegon. This is the second consecutive year in which Mr. Jorgensen has been awarded this prize.

Twenty-five prizes of $25 each were awarded to the foremen of supervisor's subdivisions, thirteen of these going to the foremen whose territories showed the best general condition, and twelve going to the foremen whose territories witnessed the greatest improvement over the previous year. In addition, prizes of $25 each were awarded to six foremen on branch lines, three prizes for the best condition and three for the greatest improvement. The Toledo-Ludington division, of which H. J. Bogardus is division engineer, was awarded the highest percentage rating of any of the divisions for the tenth consecutive year.

C. & O. Makes Careful Inspection

Accompanied by higher engineering and operating officers, the engineer maintenance of way of the Chesapeake & Ohio and his staff, together with superintendents, division engineers and supervisors of track, made an inspection of the properties, including the Hocking Valley, which formed the basis for cash prize awards to both supervisors and foremen. The trackage was divided into four groups according to the character of the track and the traffic handled over it. Prizes of $50 and $25 respectively, were awarded to the supervisors in each of the groups, whose districts received the first and second highest weighted averages. Additional prizes of $25 and $15 were awarded to foremen having the first and second-best maintained sections on each supervisor's district, and a special prize of $50 was awarded to the supervisor of the district on the system showing the greatest improvement during the year. Following is a list of the four main-track classifications and the names of the winners of the group prizes:

Group 1—Double-track main line, freight and passenger traffic: First prize, J. H. Arthur, supervisor on the Cincinnati district; second prize, W. P. Nichols, supervisor on the Russell district.

Group 2—Single and double-track main line, principally freight traffic: First prize, J. Broshears, supervisor on the Columbus district; second prize, Edward Snouffer, on District 1 of the Hocking division.

Group 3—Single-track main line, principally passenger traffic: First prize, H. R. Gibson, supervisor on the Mountain subdivision; second prize, S. Ryan, supervisor on the Chicago district.

Group 4—Secondary branch lines: First prize, J. L. Quinn, supervisor on District 4 of the Hocking division; second prize, B. Jackson, supervisor on the Coal River subdivision.

The system improvement prize for 1930 was awarded to C. E. Butcher, supervisor on the Scioto district.

On the Erie

The Erie continued in 1930 its practice of making a careful annual track inspection, using its special instrument car and inspection committees to rate each section and district on the road. This year, however, the number of awards was reduced somewhat, as was also the total amount given in awards. Altogether, 44 cash prizes, totaling $3,950, were given to supervisors and foremen for having maintained the best subdivisions and sections during 1930. First and second prizes of $200 and $100, respectively, were awarded to the supervisors on each of the three districts of the road, whose subdivisions had the highest and next to the highest ratings. Prizes of $100 were also awarded to those supervisors who maintained the best branch line on each of the New York and Eastern districts.

In addition to these prizes to supervisors, three Banner prizes of $150 each were given to the foremen whose sections received the highest ratings on each district, and 15 first prizes of $100 and 18 second prizes of $50 each were given to the foremen who received the first and second highest ratings on individual subdivisions. The supervisors who won prizes on the Erie, together with the amounts of prizes, are as follows:

Division	
New York District, Main Line	
New York—A. F. Doyle, Goshen, N. Y.	$200
New York—C. L. Connor, Paterson, N. J.	100
New York District, Branch Line	
N. R. R.—N. J. & N. Y.—J. J. Joyce, Jersey City, N. J.	100
Eastern District, Main Line	
Susquehanna—Fred Fisk, Hornell, N. Y.	200
Buffalo—W. E. Stenson, Atica, N. Y.	100
Eastern District, Branch Line	
Rochester—E. W. Trenholm, Avon, N. Y.	100
Western District, Main Line	
Mahoning—G. A. Johnson, Sharon, Pa.	200
Marion—A. Burgett, Huntington, Ind.	100

85 Prizes Awarded on Norfolk & Western

Eighty-five section foremen received prizes totalling $2,190, as a result of the annual track inspection on the Norfolk & Western. In determining the winners, ratings were established for each division, roadmaster's subdivision and section, after inspections by committees of roadmasters and section foremen. Four prizes were awarded on each roadmaster's subdivision, ranging from $40 for first prize to $10 for fourth prize. On the basis of 10 as perfect, the highest rating given to any section in 1930 was 9.46, and this was received by three foremen, all on the Pocahontas division: J. F. Rose, section No. 10, Iaeger, W. Va.; Sam Jones, section No. 17, Pageton, W. Va.; and A. C. Davis, section No. 3, Tazewell, Va. The second highest rating of 9.42 was received by W. W. Booth, section No. 31, Pocahontas division, Auville, W. Va., and by M. Brumley, section No. 8, Scioto division, Winchester, Ohio.

The Scioto division received the highest rating for the year with a general average of 9.26, which compares with

the rating of 9.22 given to the Roanoke Terminal division in 1929, which was the high rating for that year. The second highest division rating in 1930 was shared by the Roanoke Terminal division and the Pocahontas division, each with a rating of 9.25. The general average for all divisions in 1930 was 9.16, as compared with 9.11 in 1929 and 9.03 in 1928.

On the Lehigh Valley

While the Lehigh Valley does not award prizes to its foremen or supervisors in connection with its annual track inspection, it does make a most thorough inspection and publishes the results in tabulated form for distribution among all of the maintenance of way forces. In arriving at the ratings given, each of the major classes of maintenance work is graded separately, a definite percentage being given to each class. The result of the inspection for 1930 shows that the New York division, of which A. M. King is division engineer, received the highest rating of the year, having been given a grade of 99.66 per cent. The Buffalo division, of which E. J. Cullen is division engineer, received the second highest rating of 99.47 per cent, while the third highest rating of 99.46 per cent was given to the New Jersey and Lehigh division, of which R. E. Patterson is division engineer.

A study of the results by subdivisions shows that the subdivision of J. Sheehan, which includes all of the New York division, received the highest rating of 99.66 per cent, and that the subdivision of W. W. Crowley, on the Seneca division, received the second highest rating of 99.64 per cent. The subdivision having the third highest rating was that of W. F. Nichols, supervisor on the Buffalo division, this subdivision having received a rating of 99.61 per cent.

An indication of the keen rivalry between the different subdivisions and divisions of the system is seen in the fact that the ratings given to the five divisions on the road varied only from 99.25 per cent to 99.66 per cent, and that the ratings given to the ten subdivisions varied only from 99.21 per cent to 99.66 per cent. The road as a whole this year was given an average rating of 99.42 per cent, as compared with system averages of 99.48 per cent in 1929 and 99.52 per cent in 1928.

On the New York Central

In the annual track inspection on the New York Central Lines east of Buffalo, subdivision 13B of the Buffalo division, of which J. P. Sexton is supervisor, received the highest average rating for the year, 85.3 per cent. The second highest subdivision rating, 85.0 per cent, was given to subdivision 13, also of the Buffalo division, of which T. J. Sexton is supervisor.

With both first and second subdivision winners, the Buffalo division, with an average rating of 85.1 per cent, again received the highest division rating, while the Mohawk division received the second most favorable rating, 83.2 per cent. The general average rating for the Lines east of Buffalo was 83.1 per cent, as compared with ratings of 83.2 per cent in 1929 and 83.5 per cent in 1928.

In the inspection of this road the tracks are divided into classifications and then sub-divided into groups, each group within the different classifications containing only sections similar in character. Instead of awarding cash prizes, the awards are made in the form of premiums which are added to the regular compensation of the winners.

The foremen who receive the highest ratings in their respective groups are awarded monthly premiums of $5 throughout the year. In addition, the foremen who receive the highest ratings in each of four of the five main classifications receive an additional premium of $3 a month, which, with the group premium, amounts to a total monthly premium, or prize, of $8 a month. In one of the classifications $2 a month is given to the foremen with the highest ratings, in addition to the group premium of $5 a month. Supplementing the regular group and classification awards, cash prizes of $10 gold pieces are made to those foremen who have received the highest ratings in their respective groups for four or more consecutive years.

The following foremen won the classification prizes for 1930:

Classification 1, A. Burke, subdivision 13 of the Buffalo division.
Classification 2, E. Teats, subdivision 27 of the Pennsylvania division.
Classification 3, C. Persutte, subdivision 8 of the Adirondack division.
Classification 4, J. Schebell, subdivision 13A of the Buffalo division.
Classification 5, B. Bartel, subdivision 13 of the Buffalo division.

Eight of the 55 foremen winning group prizes were each awarded $10 gold pieces in addition to their regular premium awards, having received the highest ratings in their respective groups for four or more consecutive years. Five of these foremen maintained unbroken records in this regard for eight consecutive years, among whom was E. Teats, who, as noted above, was one of the classification winners.

On the Canadian Pacific

A total of $1,100 was distributed among 64 foremen on the Eastern lines of the Canadian Pacific as a result of its inspection this year. The "general manager's" prize for the best section on the Eastern lines, amounting to $100, was awarded to J. Meilke, section foreman at Petawawa, Ont., on the Chalk River subdivision of the Smiths Falls division, Quebec district. In addition to this, the largest prize, there were four "general superintendents" prizes of $50 each for the best section on each district; 14 "superintendents" prizes of $25 each for the best section on each division; and 45 "roadmasters" prizes of $10 each for the best section on each subdivision. The winners of the four "general superintendents," or district, prizes were J. Sullivan, Moosehead subdivision, Brownville division, New Brunswick district, at Brownville, Me.; A. Fisette, Trois Rivieres subdivision, Laurentian division, Quebec district, at Lanoraie, Que.; R. C. Treadwell, MacTier subdivision, Bruce division, Ontario district, at Midhurst, Ont.; and W. S. Hawkins, Parry Sound subdivision, Sudbury division, Algoma district, at Carling, Ont.

On the Southern

As a result of the annual track inspection on the Eastern lines of the Southern, during which the territory and work of each section and bridge and building foreman was given a definite rating, $2,130 was distributed in first and second prizes to 142 foremen, this including 71 first prizes of $20 each and a similar number of second prizes of $10 each. One hundred sixteen of the winners were in the track department, first and second winners being selected on each supervisor's subdivision, and 26 were in the bridge and building department, two being selected from the bridge and building gangs on each division.

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer? Have you an answer to any of the questions listed here?

To be Answered in the March Issue

1. *What are the relative advantages and disadvantages of bolting switch points to the running and stock rails through filler blocks at the heel of the points, and of using recessed heel plates which leave the points and these rails independent of each other?*

2. *From the standpoint of operation, what are the advantages and disadvantages of using lump lime as compared with hydrated lime at water-treating plants?*

3. *What precautions should be observed when gaging new rail? Why?*

4. *When necessary to deposit concrete under water, what methods can be employed? What precautions should be observed?*

5. *What advance preparation can section gangs make in the late winter and early spring that will facilitate the renewal of ties and enable them to complete this part of the season's program early in the summer?*

6. *From the standpoints of maintenance and economy, what are the relative advantages and disadvantages of stoves and hot water heaters for small stations?*

7. *With respect to what details should track foremen be required to inspect the bridges on their sections?*

8. *When excavating beneath main tracks in constructing box culverts or abutments, what methods can be employed to prevent caving of the embankment material.*

Applying Tie Plates

When applying tie plates, what method should be used in lifting the rail to avoid injury to the men doing the work ?

Recommends Jacking the Rail

By J. MORGAN

Supervisor, Central of Georgia, Leeds, Ala.

Several methods are used by foremen for lifting the rail to apply tie plates, some of which do not conform to the strict requirements of safety. The safest method is to use a track jack for this purpose and, if a large gang is at work, two or more jacks should be used. The only precautions that are required with this method is to lift the rail only high enough to allow the plates to slip in or out easily, and to make certain that the men are clear of the rail before the jack is released. Otherwise, injuries to hands or toes may result.

Should Lift the Rail with a Track Jack

By J. J. DESMOND

Division Engineer, Illinois Central, Chicago

Since the application of tie plates has become practically a universal practice on American railways, the problem of making the application by the best and safest method confronts almost every maintenance officer. To provide a safeguard against personal injury, it is good practice to lift the rail with a track jack, sufficient to permit the insertion of the tie plate. When making an application out of face, it is necessary to do more or less adzing. While doing this work, as an additional safeguard, wooden blocks of the required thickness may be inserted at several points to insure against the sudden dropping of the rail from any cause.

It is a common practice, particularly when only a few tie plates are to be installed or changed, to use claw bars or lining bars to nip the rail. This is a dangerous practice and should never be permitted, even where the greatest care is exercised in making the lift.

Employees often find themselves in emergency situations when they think they must take chances, but a routine job such as applying tie plates is not one of these, and by proper supervision and attention to detail it is possible to eliminate personal injuries. In my opinion, track jacks should always be used for lifting the rail, as their use promotes efficiency and economy and affords greater protection to the men making the application.

Use of Nipping Bars Should Be Avoided

By Assistant Engineer of Maintenance

I have canvassed a representative number of our roadmasters to get their reaction to this question. Their opinion, while not unanimous, is that the rail should always be lifted with a track jack, just enough to permit the tie plate to slip into place easily. As an added precaution, they advocate the practice of placing a shim under the rail to insure that it will not fall suddenly if the jack is accidentally tripped or slips out from the rail.

In their opinion, in which I fully concur, the nipping of the rail with a claw or lining bar should not be permitted in other than exceptional cases, because of the danger that the bar may slip and allow the rail to fall suddenly, in which event fingers or toes may be caught. It may be necessary in winter, owing to heavy track, to resort to the use of bars occasionally. Where this is done a wooden shim should always be inserted under the rail before attempting to insert the tie plate. The general application of tie plates during the winter should be avoided.

The use of bars to nip the rail is a dangerous practice under the most favorable conditions and only experienced men should be permitted to do the work when it is necessary. The best time to insert tie plates is when renewing ties, as they can be placed with complete safety before the tie is tamped, thus eliminating the necessity of raising the rail.

Has Found the Nipping Bar Safe

By A. D. HENNINGER

Section Foreman, Minneapolis, St. Paul & Sault Ste. Marie, Nemadji, Minn.

I have found that the use of a nipping bar is safe and that it facilitates the application of the tie plates, if it is used under the head of the rail instead of under the base, provided a hardwood or metal nipping block of ample size and height is also used. This method of use gives a sure grip which never fails, the rail can be raised quickly and held as long as necessary, while the move to the next point of raise is made so quickly that no time is lost.

Nipping Is a Dangerous Practice

By W. COX

Section Foreman, St. Louis Southwestern, Marmaduke, Ark.

It is the practice of many foremen to allow the rail to be nipped with a claw or lining bar when applying tie plates, particularly if only a few are to be installed. Aside from the danger of personal injury that is inherent in this practice, it is uneconomical for it requires one man on the bar all of the time and generally he can nip for only one man engaged in making the application. If the latter uses a maul to force the plate into position, as he must do frequently because of the difficulty of giving enough lift to the rail, the bar may slip and injure the nipper.

If jacks are used, one will serve two or three men and the jackman can also be used in making the application, although he should remove the lever while doing so. Jacks should always be set at the joints and centers, to eliminate the probability of "humping" the quarters, which is otherwise likely to occur.

Waterproofing Retaining Walls

Is it necessary or desirable to waterproof the back surface of a retaining wall? If so, how should it be done ?

Considers Waterproofing Necessary

By M. HIRSCHTHAL

Concrete Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

On the Lackawanna we have been waterproofing the backs of retaining walls for 15 years, being convinced that this is necessary for the better protection of these structures. Water reaching the embankment back of the retaining wall passes through the material to drains or weep holes, if they are provided, and is disposed of with varying success. This drainage is not always accomplished as thoroughly as planned, however, since varying amounts of water are retained, depending on the character of the filling material. Not infrequently this water acts against the wall under hydrostatic head, particularly when certain clays are used for filling.

Any increase in the amount of surcharge, either vertical or sloping, reduces the angle of repose of the material, so that the tendency is to approach more nearly the action of water under hydrostatic head. The result is that the water permeates the wall and, in climates favorable to such action, cycles of freezing and thawing may finally cause disintegration of the concrete. There is also a capillary action which tends to retain a certain amount of water along the side of the wall.

These considerations have led us to waterproof the backs of retaining walls and abutments. Originally we made a hot application of asphalt. We superseded this with cut-back asphalt, but at present are applying a priming coat of emulsified asphalt. This is followed by a hand application of asphaltic emulsion containing about 35 per cent by volume of asbestos fiber. This coat, which is about ⅛ in. thick, is applied with a brush or trowel.

Would Not Waterproof Gravity Walls

By C. P. RICHARDSON

Engineer Track Elevation, Chicago, Rock Island & Pacific, Chicago

Since modern methods of proportioning, mixing and placing concrete, which have generally been adopted as standard practice, produce a dense concrete, it should not be necessary or even desirable to waterproof or damp-proof the rear surfaces of plain-concrete retaining walls. If, on the other hand, poor workmanship has produced a porous concrete, a water-repelling agent is required. I consider it good practice, however, to waterproof the rear surface of reinforced-concrete retaining walls, since the stability of the wall depends on the reinforcement in a comparatively thin section of concrete, which should be amply protected against corrosion.

Experience proves the necessity of waterproofing all construction and expansion joints. The most satisfactory method of doing this is to follow the A. R. E. A. specifications for membrane waterproofing of solid-floor railway bridges, as far as they apply to expansion joints. As a rule, however, the protection coat can be limited safely to a single layer of the membrane, which should be fully protected from the direct rays of the sun until the backfilling is completed.

Except for the expansion joints, almost any commercial product sold by a reputable concern will serve for this protection. Two coats should be applied with a brush or by spraying, since a one-coat application is of no practical value. As emulsified asphalt can be applied satisfactorily while the concrete is green, it can be made to serve two purposes—as waterproofing and to prevent the premature drying of the concrete. The cost of from 3½ to 4 cents a square foot is cheap insurance against future trouble.

Waterproofing Is Generally Necessary

By A. N. LAIRD

Bridge Engineer, Grand Trunk Western, Detroit, Mich.

Retaining walls may be divided into three classes: (1) Those in which the back surface is not exposed to moisture; (2) those subject to dampness and occasional ground water; and (3) those in which this surface is exposed either intermittently or continuously to water under pressure. The first case rarely occurs, but when it does it is manifest that there is no need for waterproofing. The second class includes most of the retaining wall construction, and the third, like the first includes a relatively few special cases.

While it is possible to obtain a sufficiently dense concrete to prevent the seepage of water through the voids, it is difficult if not impossible under ordinary field conditions, with even the most rigidly controlled methods of proportioning and mixing, to be assured that the con-

crete is water tight. In addition, the formation of cracks through shrinkage, unequal settlement or unequal expansion and contraction, results in the seepage of water into the interior of the wall. Eliminating, therefore, those cases of poor aggregates and structural defects, most of the failures of retaining walls are due to the presence of water in the form of either seepage or absorption. It appears logical, therefore, that proper precautions for the protection of the structure should include special provisions to make the concrete as dense as practicable, an adequate drainage system back of the wall and the application of waterproofing to the rear surface.

For the second class, I would recommend an asphalt priming coat applied directly to the surface, followed by two moppings of hot asphalt containing five per cent by weight of asbestos fibre which should be mixed with the asphalt during the process of heating. The asbestos acts as a binder to minimize the cracking of the asphalt at low temperatures, while it also permits the application of a heavier coating than would otherwise be possible. An alternate method, which has been used with success, is to apply an iron-oxide waterproofing incorporated with an oxidizing agent. Special consideration should be given to construction and expansion joints, using sheet-lead or copper expansion shields with membrane waterproofing.

Protecting Frog Points

What practical means, if any, can be employed to minimize the damage to frog points from the pounding of passing wheels ?

Use Spring Frogs Where Practicable

By W. H. SPARKS

Inspector of Track, Chesapeake & Ohio, Russell, Ky.

In rigid frogs, the distance from the throat to the point varies from about 24 in. in No. 10 frogs to 34 in. in No. 16 frogs. For this distance the wheels have a bearing, diminishing from the full width of the head at the throat to a minimum bearing just ahead of the ½-in. point. The result is that there is greater wear opposite the point than elsewhere on the frog and this wear, combined with the slope of the wheel produces a blow on the point itself that eventually wears it down or breaks it. When spring frogs are used, the wing rail furnishes ample support to the wheels and the wear is greatly reduced; they should, therefore, be used wherever practicable.

Turnouts Should Be Well Maintained

By A. D. HENNINGER

Section Foreman, Minneapolis, St. Paul and Sault Ste. Marie, Nemadji, Minn.

Careful maintenance will reduce the batter on frog points and add materially to the life of the frog. Poor surface, whether caused by inadequate drainage, poor ties or other forms of neglect, quickly results in damage to the frog, particularly at the point. If the heel joint is allowed to get low, there is a tendency for the point to rise and thus receive greater abuse.

Turnouts should always be kept in line and correct gage, particularly at and near the frog, to reduce the tendency toward wear on the side of the points. This is especially important with the lighter rail sections. As winter approaches, turnouts should be put in first class condition, since little surfacing is possible for several months, during which the frog undergoes severe service.

Creeping rail, which crowds the frog longitudinally, tends to loosen the component parts of the frog and this adds to the abuse received by the point. If the entire turnout is kept in first class condition and the frog held rigidly in place on a firm foundation, the damage to the frog point will be definitely minimized.

Proper Attention to Maintenance Helps

By G. STAFFORD

Section Foreman, Canadian National Railways, Rosebud, Alta.

Despite the progressive improvements in frog design and manufacture, the point will always remain the weakest feature of the assembly and will be subject to severe wearing conditions. Proper attention to the details of maintenance will do much, however, to minimize the abuse which the point receives from the passing wheels.

The most important detail is the correct adjustment and efficient maintenance of the guard rail. It should be kept to exact gage and in proper longitudinal position with respect to the point. If it is to function properly, it must be fastened securely, or a constant distance from the point cannot be maintained. Loose guard rails are often difficult of detection unless carefully examined and tested with a prying bar.

The frog itself should be maintained with equal care. It should be held rigidly in position to insure that there is no lateral movement to vary the distance between the frog and the guard rail. Frogs should always be constructed with base plates to reduce the movement between the parts. If the rail shows a tendency to creep, the track should be anchored to avoid longitudinal movement of the frog, which is sure to increase the wear at the point. Drainage, line and surface are important items and close attention to these details will often double the life of the frog.

Provide a Smoother Entrance at Throat

By Engineer Maintenance of Way

It has been my observation that frog points have been more difficult to maintain since the present 1 to 20 slope of wheel tread has come into use. Frog points are usually finished to a ½-in. point and, except in a few instances, are on the same level as the adjacent wing rails. The result is that the fillet of the wheel is about ⅛ in. lower than the top surface of the point when contact is made between the wheel tread and the point, resulting in a severe blow on the point. The effect of this is that frog points are quickly battered down or broken, particularly in manganese work.

Since there is no present prospect of any change in the wheel standards, we must look for the remedy in possible alterations in the frog design. This has been done to some extent in manganese construction, by raising the surface of the wing rails about ⅛ in. opposite and ahead of the ½-in. point. This cannot be done so well with bolted or riveted frogs, however.

In most all-rail frogs, the knee bend of the wing rail is made by heating the rail and giving it the shortest possible bend. This practice results in a bad entrance obstruction to wheels facing the point, as this kink contacts with the rear surface of the wheel flanges and tends to drive the flanges laterally toward the point. Contrasted with this, all present designs of frogs have an easy wing flare for wheels trailing the point. It has been observed that it is less difficult to keep the bolts tight in trailing frogs than in facing frogs, leading to the conclusion that this is the result of the smoother entrance of the wheels.

Following this suggestion, the writer has worked out in practice a scheme for providing a smoother entrance

at the throat of the trog tor wheels approaching in the facing direction, which has given excellent results. This is accomplished by making a cold bend on a long radius to give a throat opening of 2½ in. to 2¾ in., in place of the present opening of 1¾ in. to 1⅞ in. Better results can probably be obtained by dividing the knee bend so as to provide two bends, placing the first a few inches ahead of the present location and the other opposite or a few inches back of the ½-in. point.

Freezing of Hydrants

What practical means, if any, can be employed to prevent the freezing of hydrants during the winter ?

Stable Manure Makes Efficient Cover

By Water Service Inspector

It is assumed that the question refers more particularly to the protection of fire hydrants, since they are used infrequently, and then generally in an emergency. In the territory in which I am located the protection of fire hydrants against freezing assumes considerable importance because of the long-continued low temperatures during the winter season.

The most important factor in keeping hydrants open and ready for service at all times during the winter is adequate drainage. Next in importance is the certainty that the hydrant valve does not leak. Hydrants should always be installed to such a depth that the valve is below the maximum depth of ground frost. In addition to these precautions, all of which are of fundamental importance, we always secure one or two carloads of fresh stockyards manure and pack it lightly around the hydrants late in November or early in December, placing a wooden frame of ample size around the hydrant to retain this material. The process of fermentation which takes place in this material will continue through the winter months and provide sufficient heat to keep the hydrants unfrozen till spring.

Cover and Drainage are Important

By Supervisor of Water Service

Ample cover and adequate drainage are of first importance in preventing the freezing of hydrants. There should be sufficient cover to permit the placing of the hydrant valve below the frost line. This observation applies with equal force to the drainage outlet. The depth to which they should be buried will vary according to the severity of the weather and the range of temperatures that may be expected. The maximum depth of the frost line may be as much as six or seven feet in the northern sections of this country and in Canada.

It is of particular importance that provisions be made for drainage of the hydrant. In compact soil this can usually be done by piping it to a sewer or by placing pockets of broken stone or loose gravel around the drainage outlet to facilitate the absorption of the water.

The main valves of the hydrant should not be permitted to leak, and the drain openings should be kept clear. When fire hydrants are located in wet or swamp ground, where drainage is difficult or impracticable, common table salt will prevent the hydrant from freezing. Water containing 10 per cent of salt by weight freezes at 18 deg.; a 15 per cent solution at 12 deg.; a 20 per cent solution at 7 deg.; and a 25 per cent solution at 1 deg. In some cases calcium chloride can be used to advantage, since its freezing temperature is lower than that of the salt solutions and it does not have any corrosive action on iron or brass. More rarely, alcohol is used. Some cities follow the practice, where hydrants are located in swamps, of plugging the drip and pumping the water out of the hydrant.

Emergency Rails

How many rails should be carried on an individual section? Where should they be kept? Should they be retained unused until needed, or should they be changed from time to time? If the latter, how often ?

Favors Emergency Rails at Tool House

By W. H. SPARKS

Inspector of Track, Chesapeake & Ohio, Russell, Ky.

In recent years it has been the practice of the Chesapeake & Ohio to place the section tool house at the center of the section, wherever practicable. This facilitates the keeping of all material stocks carried on the section, including emergency rails, at the tool house. This practice also makes it easier for the foreman to keep a check on the number, section and lengths of his emergency rails.

It is our custom to carry on every section, two emergency rails of each weight and length in main line service. When one is used, it is replaced as quickly as practicable. If after a reasonable time the new stock is not used it is changed in order to equalize the wear.

No Set Rule Can Be Applied

By H. R. CLARKE

General Inspector Permanent Way, Chicago, Burlington & Quincy, Chicago

Except in large yards, rail is carried on sections for emergency use and not for ordinary repairs. For this reason the number to be carried depends upon the frequency of these emergencies. The old rule of "A rail to the mile and on the mile" resulted in carrying a large amount of surplus stock, some of which was not used for months or years, if ever. On most lines, a rail to the mile is not necessary, neither can the practice be justified.

On some very heavy traffic lines a rail to the mile may be needed; if more than one section of rail should be in service on a section the number necessary may be increased, but on most of the mileage of the country, the needs are much less. So much territory and such a range of conditions are involved that a hard and fast rule cannot be applied to meet all of these conditions. Special and individual consideration must, therefore, be given to each section or district.

If new heavy-section rail has just been laid, one rail may afford ample protection to two sections for a long time. If failures occur and increase, it might become necessary to carry the equivalent of a rail to the mile or even more, if rail from stock is not immediately available. The tendency is always to carry a larger stock than is actually needed and this should be carefully guarded against.

As a rule, emergency rail should be kept near the tool house rather than distributed along the line. It is a matter of only a few minutes to run in for and return with a rail when it is needed. If kept at a central point, it is easier to maintain a check on the stock and its condition can be noted to better advantage. Here, a rack or skid can be constructed to facilitate the handling of the rail on or off the car with a limited number of men.

Emergency rail should match the rail in service as nearly as practicable. For this reason it should be changed at intervals of one to three years, depending on the rate of wear of the rail in the track. Generally, it should not be necessary to make this change more than once during the service life of the rail, and even this change can sometimes be avoided by supplying second hand rail of the proper section when the new rail is laid.

Depends on Condition of Rail in Track

By J. MORGAN

Supervisor, Central of Georgia, Leeds, Ala.

The number of emergency rails that should be carried on an individual section depends largely on the age and condition of the rail in the track. If the rail is old and somewhat worn or failures are occurring, a larger emergency stock is called for than if it is new or nearly so. In my experience, one rail for each track mile should be kept on main lines. I know of no more suitable place for holding this rail than at the mile posts. If on single track, one rail should be placed on a rack; if on double track, two rails.

The cost of changing the rail from time to time is costly and probably is not worth what it costs. Yet, unless the maintenance organization includes a welder who can build up the rail ends, there will be a bad joint if an unworn emergency rail is laid against a worn rail. To avoid this condition, I favor changing the rails as the rail in the track wears.

There Should Be One Rail to the Mile

By J. J. HESS

General Roadmaster, Great Northern, Seattle, Wash.

It is good practice to keep at least one emergency rail for every mile on the section. They should be kept at mile posts except where the latter are located in yards, or near turnouts, highway crossings or other places where the placing of the rails would be objectionable. In such event they should be located at some convenient point where there will be no danger of injury from them. On branch lines a smaller number may be sufficient, say one on every alternate mile, or even less frequently, depending on the character and weight of rail in service and the volume of traffic.

On main lines, there is usually sufficient demand for emergency rails so that there is seldom any need for special provisions for changing them from time to time. The only object in changing them is to keep the wear on the emergency rails approximately equal to that of the rails in the track. On branch lines the amount of wear is usually so limited that no good purpose is served in making this exchange, even though the emergency rails are not required over a period of years.

Local Conditions Govern Largely

By W. G. BROWN

Engineer Maintenance of Way, Florida East Coast, St. Augustine, Fla.

Local conditions alone should govern the number and location of emergency rails. So many factors enter into the question that, in my opinion, no set rule can be adopted to cover the number of rails to a section, their location or the frequency with which they should be exchanged with rails that are serving in the track.

On large systems where out-of-face rail renewals are frequent on main lines and the relayer rail is utilized on less important lines, it would not seem to be economical to retain proportionately as heavy a stock of new emergency rails as on a smaller road which uses the same section over its entire mileage and which has less frequent renewals to supply repair material. The allotment should depend on mileage and rate of wear, the determining factors for the latter being tonnage, alinement and grade. On the road with which I am connected, with 90-lb. rail in service, we find that one rail to the track mile is adequate.

Having determined the expected requirements, it is preferable to distribute emergency rail at equal intervals to minimize truck haul. On lines of dense traffic or those with small forces, it is important that trucking distances be as short as practicable. I can see no advantages in central storage sites, except the saving of the cost of rail rests and the avoidance of criticism if they should be left empty.

Periodical changes of emergency rails in and out of the track is advisable, since it equalizes the wear. The frequency with which this is done must be determined by the rate of service wear, intervals of 8 to 12 months giving satisfactory results on our road for tangent track, with shorter intervals on curves.

Prefers a Centralized Location

By M.W. MICHAEL

Roadmaster's Clerk, Southern Pacific, Merced, Cal.

The number of rails to be carried as emergency stock should vary with the age and condition of the rail in the track. Generally, one rail to the track mile is sufficient for the individual section. A larger supply should be available at a central location on each roadmaster's district or at a nearby store.

At this time we are maintaining rail racks at alternate mile posts, each rack holding two rails. It is now the general thought among roadmasters, general foremen and section foremen that rail racks are obsolete. With the general use of the motor car, a foreman can pick up a rail at section headquarters and take it to the point of use as quickly, or even more quickly, than he can remove it from a rail rack and replace it from stock, as he must do to avoid criticism for having an unfilled rack. If the emergency rails are kept at the section headquarters, they can be handled more easily and economically than out on the line and the extra handling to replace the one used is eliminated.

It is the rule here to retain emergency rails unused until needed. Our practice of building up joints by frequent welding makes it unnecessary to change them and we can see no advantage in doing so.

Change Rails for Curves Frequently

By N. F. ALBERTS

General Foreman, Chicago, Milwaukee, St. Paul & Pacific, Chicago

The number of emergency rails that should be kept on an individual section will depend largely on the class of main line track, the length of the section and the age of the rail in service. Rails that have been in service for several years under heavy main line traffic are likely to show more breaks than rails only one or two years old.

A five-mile section on double track should have from 8 to 10 rails on hand, two of which should be kept at the tool house and the remainder out on the line, one for each mile of track. The racks upon which they rest should be at such height that the rail can be slid down to an ordinary push car for loading. Emergency rails should be changed at least once a year to maintain the same surface and height as the rail in the track. If this is not done regularly, the emergency rail does not match well with the rails in service and bad joints and rough track result, with increasing batter on the higher rail. On curves of 3 deg. or sharper, the rails should be changed

at least once every six months, preserving one rail for the high side and another rail for the low side. This latter is very important, because of the variation in the amount and contour of the wear on the opposite sides of curves.

Thermometers in Laying Rail

When laying rail in winter, how should the thermometer be used to insure that the correct expansion is being provided? Does this differ from the method that should be followed in the summer? If so, how ?

Rail Temperatures Are Important

By E. D. SWIFT
Engineer Maintenance of Way, Belt Railway of Chicago

Since it is through the temperature of the rail that the amount of expansion to be used is established, it follows that a thermometer should be used in such a manner as to give readings that will closely represent the rail temperature at the time of laying. A common method is to place the thermometer in contact with the shady side of the rail, out of the direct rays of the sun, for a sufficient time to eliminate all influences other than the rail temperature. This method has both recommended practice and successful results to support it.

Considering, however, that the expansion in a 39-ft. rail increases by only slightly more than 1/16 in. for every 25-deg. increment in temperature, it seems that the small difference that ordinarily exists between rail and atmospheric temperatures near the ground should not be great enough to demand that all readings shall be taken on the rail, if convenience would be served by not doing so.

Views held by some experienced maintenance officers are to the effect that it is impracticable to maintain even expansion gaps and that for this reason there is no justification for so small a rate of change as that contained in the expansion table which appears on page 243 of the A. R. E. A. Manual, 1929 Edition. It is the belief of these officers that a smaller number of shim thicknesses would greatly simplify rail laying and give equally satisfactory results.

Any belief that even expansion gaps are attainable in practice, pre-supposes that the only forces present are those resulting from temperature changes, that every rail expands and contracts evenly and in unison and that all movement is from the middle of the rail toward the ends. A convincing argument for fewer sizes of shims is that such ideal conditions never exist for every trackman knows that uniform expansion is never maintained, even under the most favorable track conditions.

Methods Are the Same in Summer and Winter

By C. W. BALDRIDGE
Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

All steel contracts as it cools and expands as it grows warmer. So great is the force exerted by expanding steel that probably the most powerful pressures ever produced artificially have been obtained by placing a piece of cold steel between rigid supports and applying heat to it. Although the amount which steel expands or contracts within the limits of seasonal temperatures cannot be detected visually in a single rail, being about 5/16 in., yet at the temperature of rolling, each rail must be cut to a length of 39 ft. 7 in. in order to obtain a finished rail 39 ft. long.

Although the expansion which takes place in a single rail between zero and 100 deg. is small, the accumulated expansion in one mile amounts to slightly more than 41 in. For this reason, if rail is laid tight at zero temperature, sun kinks or wavy track will invariably result in hot weather. This fact indicates the importance of strict attention to the temperature of the rails when they are being laid in the track.

To determine the correct thickness of shims at any season, a rail-laying thermometer should always be used, placing it on the rail with the mercury bulb in direct contact with the metal. The coolest part of the rail should always be taken. If there is any doubt as to which is the coolest part, trial should be made at different places until this is determined definitely. When the temperature has been determined in this manner, shims of such thickness should be used as will equal the expansion that will be caused by an increase in the temperature of the rails during the hottest summer weather. It should be borne in mind that in hot weather, but not in cold weather, the temperature of the rails in the track, where they are exposed to the direct rays of the sun, will usually be about 30 degrees higher than the temperature of the air in the shade, as commonly quoted.

The method of determining the temperature of the rails in summer does not differ from that in winter, but it is of much greater importance that the temperature be determined accurately during cold weather, because of the greater difference between the temperature of the rails when laid and the maximum temperature that may be expected in service.

Pile Driver Equipment

What tool and supplementary equipment should be provided for pile driver outfits ?

Combination Pile-Drivers and Derricks

By F. O. DRAPER
Superintendent of Bridges, Illinois Central, Chicago

On the Illinois Central we use combination pile drivers and bridge derricks exclusively, for the reason that the wide variety of applications for which they are adapted permits a very high use factor, as contrasted with the low use factor that is ordinarily possible with the usual type of track driver. We use the derricks for wrecking, laying rail, loading and unloading material, transferring bad-order cars and many other purposes, in addition to their primary purpose of driving piles, handling timber bridge work and erecting bridge steel.

A foreman and eight men can operate one of these outfits, which includes the self-propelled pile driver, an idler car, a tank, two bunk cars, a kitchen and dining car and the necessary tool and material cars.

1 Drop hammer and bonnet.
1 Follower cap.
1 No. 2 steam pile hammer.
1 Set of drop-hammer leads, 32 ft. long.
1 Set of steam-hammer leads, 32 ft. long.
4 No. 2 steam-hammer striking plates, 11¼ in. in diameter and 2 in. thick.
2 Pile chains, 6 ft. long, ⅝ in., with open hook.
1 Pair of timber hooks.
1 Doz. ¾-in. ship augers, 18-in. pod.
1 Power-driven wood-boring machine.

2 25-ton screw jacks.
2 14-in. telescope screw jacks.
4 8-lb. double-faced mauls.
4 12 lb. spike mauls.
4 Lug hooks.
4 Cant hooks.
4 Picks.
8 No. 2 shovels.
2 10-ton steamboat pulling jacks.
6 5-ft. cross-cut saws.
6 Steel timber bars, 5 ft. long, 1⅛ in. in diameter.
4 Track chisels.
8 S-wrenches for ¾-in. bolts.
2 Double-end claw bars.
6 Double-bitted axes.
1 Grindstone.
2 No. 1 track jacks.
2 Wooden snatch blocks for 1¾-in. rope.
200 Ft. of 1¾ rope runner line.
1 Set of ¾-in. two-ply wood blocks.
200 Ft. of ¾-in. rope.
300 Ft. of ⅝-in. plow-steel cable.
300 Ft. of ¾-in. plow-steel cable.
50 Ft. of 1½-in. steam hose and fittings.
1 Hand pump for washing boiler.
1 Extra-gang motor car.
1 Push car.
1 Set of 30-ton, two-sheave, steel blocks.
4 Each, yellow and green flags—metal.
4 Each, yellow and red flags—cloth.
2 Each, red and green lanterns.
6 White lanterns.
1 20-gal. water keg.

Power Driven Tools Are an Advantage

By R. H. GILKEY

Division Engineer, Central of Georgia, Savannah, Ga.

For driving piles the steam hammer has many advantages over the older drop-type hammer, among them being its greater efficiency, a reduction in the time necessary to drive a pile and the fact that this type of hammer largely eliminates the damage to piles which is so prominent an objection to the drop hammer, particularly when hard driving is encountered. To be entirely satisfactory, a pile driver should be equipped with telescoping leads to give a wider range in the length of piles that can be driven, and the depth below the rail to which they can be driven.

In addition to the ordinary list of small tools, lines, blocks, jacks and other standard equipment, which will vary only slightly with local conditions, a pile driver should always be fitted with an air pump or compressor, or a generator set, and equipped with a full complement of power-driven tools for boring, sawing, etc., with special tools which can be used under water. A motor car and trailer are essential for transporting the gang and handling material. To permit night work in emergencies, the outfit should be equipped with portable acetylene lights.

Depends on the Character of Work

By H. M. CHURCH

General Supervisor of Bridges and Buildings, Chesapeake & Ohio Richmond, Va.

The selection of supplementary pile-driver equipment should be based upon the character of the work to be done by the outfit, rather than upon a rigid list which is distributed uniformly to all outfits, regardless of the type of work to which they are assigned. Pile driving outfits should be classified between (1), those for heavy duty, including work of the nature ordinarily done by regularly-assigned pile driver crews; (2), those which are assigned to regular carpenter gangs and need operators and equipment only occasionally; and (3), convertible machines which are adapted for both pile driving and crane work.

Outfits falling in Group 1 are used for extensive pile driving, where the machine and organization are in continuous service and, since this is a special and somewhat unusual condition, will not be discussed further, except to add that, while they are generally equipped with steam hammers, an auxiliary drop hammer should be available for emergency use, and that such units should always be provided with power cut-off saws.

For Group 2, no tools are necessary other than the standard assignment to carpenter gangs engaged in their regular bridge work.

The convertible units can be operated more efficiently if provided with auxiliary equipment, since they perform a wider range of work. In addition to the usual complement of small tools, jacks, ropes, cables, etc., they should have two or more booms of different lengths, swinging leads, a generator for magnet operation, clam shell and drag-line buckets, and steel erection equipment.

Opening Shop Doors

Where it is necessary to open large doors in locomotive and car shops during cold weather, what means, if any, can be employed to minimize the fluctuations of temperature near these openings ?

Additional Radiation Gives Solution

By A. T. HAWK

Engineer of Buildings, Chicago, Rock Island & Pacific, Chicago

Large door openings, which it is necessary to provide in locomotive and car shops for the purpose of admitting or removing locomotives and cars, create a difficult heating problem, particularly in severe climates. The only economical solution which I have found is to install additional radiation to minimize the fluctuations in temperature.

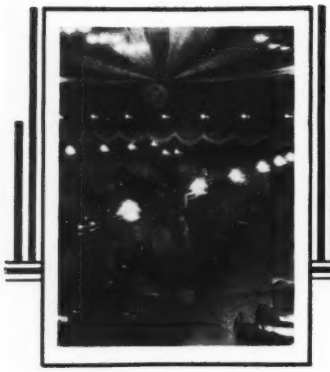
When such openings exist there is always more or less cold-air leakage that cannot be avoided. By properly locating the radiation, whether direct or indirect, a better circulation of the air through the building is obtained, since the air passing over the radiation receives an impulse somewhat like that given by a fan-driven unit heater.

Unit Heaters Give Quick Relief

By Supervisor of Bridges and Buildings

In the northern sections of the country the opening of large doors in locomotive and car shops causes a sharp reduction in the temperature near the opening, which may be felt throughout the entire shop, causing great discomfort to the workmen. Furthermore, large door openings can seldom be constructed so that there will be no leakage when they are closed.

Owing to complaints received from one shop where it was necessary to open the doors frequently, we decided to install unit heaters of large capacity on either side of each door opening. While these heaters do not mitigate the inrush of cold air while the doors stand open, they have minimized the time it takes to restore the temperature in the building after the doors are closed. During severe weather one unit at each door is operated at reduced speed, the other remaining idle while the door is closed, to care for the cold-air leakage. Both are operated to maximum capacity after the doors are opened until normal temperature is restored.



NEW AND IMPROVED DEVICES

A New "Rotator" Rock Drill

THE Sullivan Machinery Company, Chicago, has recently added a new member to its line of air-operated Rotator rock drills, which has been designated as Class L-6. The new drill is designed to accomplish drilling in a wide range of materials and is said to be effective in all but the softest and most broken ground.

The L-6 rotator drill.

The L-6 drill is substantially similar in construction and operation to the L-7 and L-8 Rotator rock drills which are among the line of drills manufactured by this company. In all of these drills, the rotation of the bit is derived from a rifle bar and a ratchet at the rear end of the machine. The rifle bar projects forward into a rifle nut, which is threaded into the rear end of the piston. Rotation of the bit occurs on the return stroke when the pawls engage the ratchet ring, this action then being transmitted to the rifle bar, thence to the rifle nut and the piston, which is caused to turn. The retaining bushing, rotating chuck and steel rotate with the piston. The independent differential three-spool valve with which the L-6 is equipped is an improved modification of the valve that has been used in Sullivan drills for a number of years. This improved valve is said to impart a powerful yet rapid blow to the piston.

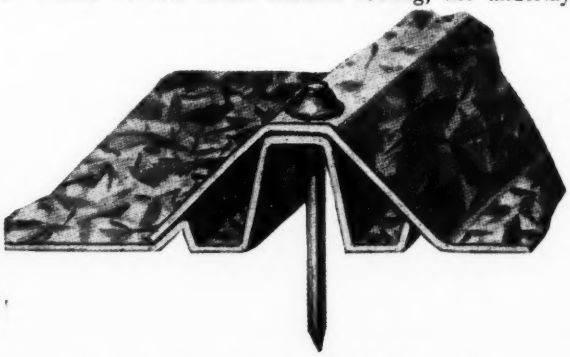
The throttle valve of the new drill is so constructed as to permit four settings in order to provide for the proper amount of air for any drilling operation. A fifth position of the throttle causes a jet of live air under full pressure to enter the hollow steel, thus effectively clearing the hole of cuttings or sludge. The L-6 drill is available in either the hollow piston "dry" type or in the water tube type. For the latter type, a water attachment is provided by means of which a jet of air and water, combined under pressure, is discharged through the drill steel to clear the hole.

The overall length of the new drill is 26 in. and the weight is 58 lbs., being 60 lbs. with the water tube attachment. It will drill to a depth of from 12 to 15 ft. with ease, and the maximum diameter of hole that can be drilled is 2⅞ in. The L-6 drill is a one-man tool and when horizontal or angle holes are being drilled, a specially constructed cradle may be used to support the drill.

The new drill in use on railway construction work.

Roofing Provides Tripple Seal

A NEW design of galvanized sheet-steel roofing has been developed recently by the Inland Steel Company, Chicago, in which the shape of the joints between adjacent sections constitutes a departure from the conventional type of design. In this roofing, which is known as Inland Perfect Drain channel roofing, the underlay



A cross section through a joint in the roofing

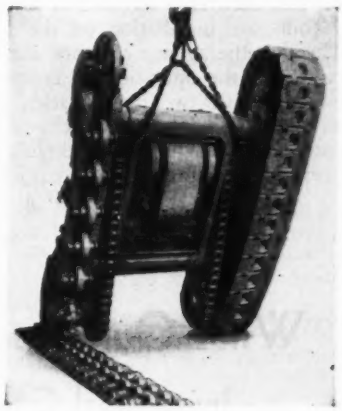
edge of the section has a relatively high inverted V with a parallel shallow channel or trough on each side. The overlay edge of the roofing consists simply of an inverted V which, in an installation of the roofing, covers entirely the underlay edge of the adjacent section.

This type of joint affords triple protection against the penetration of water. Any water that may happen to be forced under the inverted V of the overlay section flows down to the eaves in the first channel. The inverted V of the underlay section is considered to be sufficiently effective in preventing the further penetration of the water, but the second shallow channel is provided as a final measure.

This roofing is of the three-V type and the V formation is on 12-in. centers, one sheet covering 24 in. It is made of either 26, 28 or 29-gage sheet steel and is furnished in lengths ranging from 6 to 12 ft.

New Mountings for Bucyrus Erie Machines

THE Bucyrus-Erie Company, South Milwaukee, Wis., has equipped its E-2 Diesel dragline with a new style, improved, caterpillar-type mounting, which is furnished in a standard size and several special sizes. The standard mounting has treads 27 in. wide which give the truck an overall width of 10 ft. 6 in. This mounting has an overall length of 13 ft. 8½ in. and a bearing area of 51.9 sq. ft. Another truck, having 27-in. treads and the same overall width as the standard mounting, is 15 ft. ¾ in. long and has a bearing area of 57 sq. ft. It is said that either of these models may be loaded on a flat car without removing the treads.



Underside of the new treads.

Wide treads are also offered for both the standard and the extra-long lengths of tread. The standard-length truck with wide treads has an overall width of 11 ft. 8 in. and a bearing area of 63.3 sq. ft., while the extra-long truck with the wide treads has the same overall width as the standard truck and a bearing area of 70.8 sq. ft.

This machine is steered from the cab and is equipped with several new developments which are designed to facilitate steering. The new mounting is chain driven and is somewhat similar to the caterpillar mounting that is used on other Bucyrus-Erie machines.

Northwest Develops New Dragline Bucket

THE Northwest Engineering Company, Chicago, Ill., has developed a dragline bucket in which are embodied several new features that are said to give the bucket great strength and unusually light weight. These features are attributed partly to the use of new principles of design and partly to the use of special alloy steels in the construction.

The outstanding feature of the new bucket is the design of the arch, which is constructed of an I-beam section that is designed to withstand severe shocks. The hitch is placed in such a manner that the force of blows when striking a bank is taken on the arch and not on the side plates. The lip is made of rolled alloy steel and is welded directly to the arch, both of which are heat-treated as a unit.

The basket or bucket proper is formed from a single piece and is welded at the corners. This type of construction presents a smooth interior that is said to divest itself quickly of sticky materials. The dumping sheave is designed to promote maximum cable life, the dump sheave and hoist trunnion pins are of hardened steel and all castings are heat-treated. All welding work on this bucket is done by a special method that is said to assure a ductile, flexible weld that withstands shock. In tests the bucket has been subjected to a load of 34,000 lbs. without suffering permanent deformation.

The new Northwest dragline bucket

A New Thawing Powder

A SPECIAL form of melting powder, known as Nivosal, which contains qualities making it specially suitable for the melting of snow and ice around switches, has recently been introduced in this country from Germany by the Monmouth Chemical Company, of Chicago. This product is a fine to medium coarse granular powder having a gray color. A saturated solution of this powder in water has a freezing point of —27.4 deg. F. and the material is said to melt ice or snow efficiently at a temperature as low as —16.6 deg. F.

The value of Nivosal as a snow-melting agent is not due alone to the low melting point of the solution in water, but arises in considerable part from the fact that it generates heat when placed in water or moistened, as indicated by the fact that equal parts of this powder and water are brought almost immediately to the boiling point upon being combined. It is said that neither the dry powder nor the water solution has a corrosive action on metals, that they will not injure the skin, clothing or shoes, and that the powder is not inflammable under any conditions.

The claims for the practical use of Nivosal as a snow melter are based on experience with its use in Germany, where it was developed as a result of a special research

undertaken after severe sleet storms and low temperatures several years ago. It is said to have been used successfully by the German railways to keep switches and other trackwork clear of snow and ice, and can be used also to melt ice on platforms, walks, steps, pipe valves, etc.

Owing to its higher melting power and greater cost as compared with common salt, the best results are obtained by using Nivosal in limited quantities as needed. The importers recommend its application with a small spreader, shaped somewhat like a dustpan, or with some standard make of dusting machine. As in the case of salt, the time for which a given application will be effective, depends in some measure on the amount of ice or snow present or precipitated, or the extent to which the chemical solution is carried away by drainage. The amount needed, however, is much less than the proportions ordinarily employed in the application of common salt for this purpose.

A New Type of Automatic Crossing Gate

WHAT is said to be the only automatic hydraulic crossing gate on the market has been developed by the Automatic Safety Signal Gate Company, Louisville, Ky. Although intended to be entirely automatic in its operation, it can also be operated manually or by a combination of these two methods.

Manual operation is necessary only where there are irregular switching movements which would keep the gates closed, even though the train is not approaching the crossing or will not cross it. By means of an auxiliary switch, the tower man can open or close the gates at will, regardless of the position of the train. Should he neglect to open or close the gate, however, after operating it by means of this switch, the next train to enter the block will restore the automatic operation.

The automatic safety signal gate

Every installation, whether it consists of one, two or four gates, is operated by a master unit which is controlled through a track circuit. The individual gate arms are operated by a piston moving in a cylinder to which the fluid, a non-freezing, pale semaphore oil, is transmitted from a hydraulic pump in the central or master control unit. This pump operates only while the gates are being lowered, the gate arms being held in the closed position by an electric holding valve, which functions as long as a train occupies the track circuit. As soon as the track circuit is clear, the solenoid which controls this valve is de-energized and the gates return to the open position by gravity, at the same time forcing the oil back into the reservoir.

The gate arms are designed to be positive in their movements of closing and opening. Automatic control of the pressure makes it possible, however, to stop a descending arm with one finger. For this reason, it is said that there is no possibility of injury to a person or vehicle as a result of the closing of the gate. The arms are also constructed to swing outward at an angle of 90 deg., so that a trapped vehicle can go through the closed gates without injury to either the gates or the vehicle.

The normal time for lowering the gate arms is 15 sec., but the speed of descent can be adjusted to give any interval between 3 sec. and 32 sec. The illustration shows a four-gate installation on the Louisville & Nashville. Through the agency of track circuits, protection is provided for the operation of trains in both directions on either of the two main tracks, as well as for certain irregular switching movements. It is claimed that this gate has been tested thoroughly under every possible operating condition, with satisfactory results.

What Our Readers Think

Inner Steel Guard Rails

TO THE EDITOR:

An answer which appeared on page 354 in the "What's the Answer" department of Railway Engineering and Maintenance for August, escaped my notice at the time the question was propounded. I have been deeply interested in reading the answers, since the outside wooden guard rail is practically never used on the three railways with which I have been connected since coming to Argentina.

As your correspondents point out, the inner steel guard rail is most necessary for guiding derailed wheels across a structure, but I doubt whether anyone imagines that this is the function of an outside wooden guard rail. As I view the subject, the wooden guard rail is purely for tie spacing. On this assumption, the roads in this country have dispensed with its use, and space the ties on bridges by bolting them to the flanges of the girders or to the longitudinal floor members.

Theoretically, this practice has its weak points, but it works out satisfactorily in practice, especially in a country where all ordinary soft wood must be imported from great distances. In fact, it is for this reason that timber trestles are practically unknown on Argentine railways. I must admit, however, that I do not see how this method could be followed with safety or made practicable on timber trestles, since the number of bolt holes that would be necessary would weaken the wooden stringers to a great extent.

Argentino.

NEWS OF THE MONTH

Crossing Accidents Fewer

Total fatalities at highway grade crossings in the first eight months of 1930 amounted to 1,286, a reduction of 218 as compared with the same period in 1929. The number of persons injured in this period totaled 3,393, a decrease of 683 as compared with 1929.

Rail Orders Still Active

Within recent weeks six railroads have placed orders for rail amounting to 340,248 tons. Of these, the New York Central has ordered 170,000 tons, the Baltimore & Ohio 75,000 tons, the Erie 41,748 tons, the Louisville & Nashville 20,000 tons and the Atlantic Coast Line 18,500 tons.

Prepaid Tickets

The Chicago & Eastern Illinois has placed in effect with the southeastern lines, a prepaid ticket arrangement, whereby anyone wishing to provide transportation for a distant person may deposit the money for the railroad fare with the railroad's local ticket agent and the agent in the city of the receiving person will deliver the ticket.

Two-Cent Fare Gets Business

An increase of 103 per cent in the passenger business of the three daylight trains which are operated by the Texas & Pacific, between Ft. Worth, Tex., and Big Spring, occurred in the 16 days following the recent introduction of a 2-cents-a-mile passenger rate. The passenger fare between these points was lowered as a means of meeting automobile and motor-coach competition.

The Cost of Transportation

A study which has just been completed by the Bureau of Railway Economics, shows that the actual cost of transportation by inland waterways per ton-mile, when all of the underlying factors are considered, exceeds considerably the rates of railways paralleling the waterways. Transportation costs on the Mississippi river are found to be not less than 11.17 mills per ton-mile while the average freight charge per ton-mile of eight railways more or less paralleling that river is 10.09 mills. Similarly on the Ohio river the rate is not less than 12.36 mills per ton-mile as compared with the average freight charge of seven railways of 8.83 mills per ton-mile. Transportation costs on the New York State Barge Canal are 19.41 mills per ton-mile as compared with the railway rate of 10.90 mills per ton-mile.

Kansas Roads Asked to Discharge Mexicans

Six railroads operating in Kansas have received a joint letter from Governor Clyde M. Reed of that state requesting them to send their Mexican employees back to Mexico and to replace them with Americans, as a means of relieving unemployment. The letter was drafted by Governor Reed after a conference with a representative of President Hoover, who is engaged in unemployment relief work in the Southwest.

Employment Declines

The number of employes on Class I railways as of the middle of September was 1,485,906, which was a reduction of 14.98 per cent as compared with the same month of 1929, according to the monthly report of the Interstate Commerce Commission. The maintenance of way and structures group showed a reduction of 105,757 employees, while the decrease in the maintenance of equipment and stores group was 66,749 and in the transportation group 64,079.

Big Crossing Program

The grade crossings which the New York Public Service Commission is to consider for elimination in 1931 include 92 projects and involve a total estimated cost of $33,887,700. These are in addition to the projects which were carried over from the 1930 program and which involve an estimated expenditure of $36,547,000. The total expenditure estimated for 1931 is, therefore, $70,435,400, which is $8,000,000 greater than the similar figure for 1930.

I. C. C. Appointments

Commissioner Ezra Brainerd, Jr., has been elected chairman of the Interstate Commerce Commission for the ensuing year to succeed Commissioner Frank McManamy, in accordance with the policy of the commission to rotate the chairmanship each year. T. M. Ross, principal attorney for the Bureau of Valuation of the commission has been appointed assistant general solicitor of the bureau, to succeed Oliver E. Sweet, who was recently appointed director of the Bureau of Finance.

Alaska Road Has Deficit

The deficit of the government-owned Alaska railroad for the fiscal year ended June 30, 1930, was $1,231,998, an increase of $281,286, or 29.6 per cent, over the previous year, according to the annual report of the governor of Alaska to the Secretary of the Interior. Passenger revenues showed a decrease of 5 per cent, while freight revenues, rail lines, increased 1.3 per cent, and the total of all tonnage increased 1.6 per cent.

Doak Secretary of Labor

On November 28, President Hoover appointed William N. Doak, national legislative agent of the Brotherhood of Railroad Trainmen at Washington, D. C., as secretary of labor in his cabinet to succeed James J. Davis, who resigned following his election as United States senator from Pennsylvania. Mr. Doak is the second man from the transportation industry to enter the president's cabinet, Col. Robert P. Lamont, secretary of commerce, having been president of the American Steel Foundries at the time of his appointment.

Store-Door Service

The question of providing store-door collection and delivery service in the larger centers is now receiving serious consideration from the railways and a few of them have already instituted such service as a means of meeting highway competition. The South Brooklyn Railway Company has introduced a store-door freight service by motor truck in the borough of Brooklyn, New York City, which is designed to co-ordinate with the rail service of carriers and contract terminals. In this service the railway provides empty trailers at the door of the shipper for outbound shipments and delivers loaded trailers at the shippers' door for inbound shipments. The Chicago & North Western, on December 3, established container shipping service between Chicago and Milwaukee, Wis., which involves the use of containers having a capacity of 417 cu. ft. and handled in gondola or container cars.

Several combinations of this service are offered, depending on the manner of handling the containers between the door of the shipper or of the consignee and the railway stations.

Finds Few Defective Cars

According to the annual report of the Bureau of Safety of the Interstate Commerce Commission, only two per cent of the 1,301,040 freight cars inspected during the year were found defective. This is the lowest percentage on record. The report also states that airbrake tests, made on trains which were ready for departure from terminals, covering 113,583 cars, showed that only one per cent were out of order. In connection with rail failures, it was stated that the Sperry transverse fissure detector car has been used on 18,000 miles of track, and that 10 of these cars are now, or soon will be, in service.

Railroads are Large Advertisers

More than $8,000,000 was spent for advertising in newspapers and magazines in 1929 by 46 railroads of this country, according to records compiled by Sales Management. The amount spent on newspaper and rotogravure space totaled about $7,000,000, while that expended for space in magazines totaled $1,009,884. In the use of newspaper space the railroads ranked sixth among the 61 classifications of advertisers and their use of space in this medium amounted to 23,257,509 lines. Of the 46 railroads, the Pennsylvania ranked first in the amount of newspaper and magazine space used, while the Atchison, Topeka & Santa Fe ranked second, the Southern Pacific third, and the New York Central fourth.

First Quarter Traffic to be Lower

With one exception, the estimates of the various shippers' regional advisory boards for carloadings in the first quarter of 1931 show anticipated decreases under the same period of 1930, ranging from 1.1 per cent to 10 per cent. The exception is the Southeast Shippers' Board, which estimates that the carloadings in that region for the first three months will practically equal those for the same period in 1930. The decrease of 10 per cent is estimated by the Pacific Northwest Shippers' Advisory Board, while that of 1.1 per cent is expected to take place in the Atlantic States region. The Trans-Misouri-Kansas Shippers' Board expects a decrease in that territory of 4.4 per cent, while a decrease of 6.9 per cent is expected in the Great Lakes region.

Alton Sold to B. & O.

On December 11, the Chicago & Alton, which has been in receivership since 1922, was sold at public aution in foreclosure proceedings to representatives of the Baltimore & Ohio for $23,000,000. The B. & O. also assumes obligations of the Alton which raise the purchase price to between 75 and 80 million dollars. Acquisition of the Alton gives the B. & O. an entrance into Kansas City, Mo., and therefore connections at that point with western roads. It also gives the B. & O. a wholly-controlled route between that city and New York of about 1,390 miles. In the Interstate Commerce Commission consolidation plan the Alton was allocated to the Baltimore & Ohio System, or System No. 5.

Pennsylvania to Contest I. C. C. Decision

On December 6, the Pennsylvania Railroad and the Pennsylvania Company were ordered by the Interstate Commerce Commission to divest themselves within six months of all stock of the Lehigh Valley and the Wabash. It was held by the commission that the acquisition by the two companies in 1927 and 1928 of 48 per cent of the stock of the Wabash and about 49 per cent of that of the Lehigh Valley was a violation of the Clayton anti-trust act. This decision is regarded as a step toward the formation of a fifth eastern system, built around the Wabash and the Lehigh Valley. The Pennsylvania holds that the decision of the commission involves an erroneous conception of the Clayton act, and has expressed the intention to take the matter before the courts.

Recapture Repeal Asked

In its annual report to Congress, which was made public on December 4, the Interstate Commerce Commission recommended repeal of the recapture clauses of Section 15a of the interstate commerce act and also of the provision in that section for a general railroad contingent fund. The recapture clauses provide that any carrier earning in excess of 6 per cent of the value of its property in any year shall pay to the commission one-half of this excess and that the funds thus collected shall be placed in a general railroad contingent fund to be administered by the commission The report of the commission revealed that during the 10 years that the law has been in effect only $12,697,958 has been collected from the railways under its provisions. The commission gives as one of the reasons for its recommendation the fact that litigation over the valuation of railway property is conducted at great expense to the commission, the railways and the public.

N. & W. Uses Radio

The annual efficiency meeting of the Norfolk & Western, which was held on December 5, was carried to more than 4,200 employees of that road by telephone and radio, instead of being available to only about 500 delegates as in the past. These annual meetings are held for the purpose of stimulating efficiency, loyalty and friendly relations among the employees. This year employees meeting in five different cities heard at least one address from a speaker who was present, in addition to the other addresses that were brought in by radio and telephone. At eighteen other points assemblies of employees were reached entirely by radio, while an indefinite number of employees heard the program by radio in their own homes. A number of vice-presidents and other officers of the road were the principal speakers and their addresses were designed to acquaint the employees with the present adverse railroad situation.

Would Curtail Mechanical Conventions

In view of the present business conditions the various railway mechanical department associations which usually hold annual meetings or conventions in the spring or fall, have been asked by the General committee of the American Railway Association, Mechanical division, to eliminate these meetings in 1931. A subcommittee has also been appointed to develop "what consolidations can be made in the various railway mechanical conventions in the interests of economy and approved handling of mechanical subjects."

Freight Traffic Statistics

Freight traffic handled by the Class I railroads in October, 1930, amounted to 39,291,972,000 net ton-miles, which was a reduction of 17.9 per cent under the same month of 1929, and of 18.5 per cent under October, 1928, according to reports compiled by the Bureau of Railway Economics. In the first ten months of 1930 the roads handled 360,783,628,000 net ton-miles of freight, which was a decrease of 13.6 per cent under the corresponding period of 1929, and of 9.2 per cent under 1928. The average speed of freight trains in October was 13.7 miles an hour, which was the highest speed for any October on record.

Railroads Answer I. C. C.

The Association of Western Railway Executives has filed a statement with the Interstate Commerce Commission outlining a suggested program of financial relief for the western roads in answer to a previous statement of the commission saying that the roads had as yet failed to propose any action deemed feasible by the commission. The statement suggested that the commission postpone for not less than a year from January 1, 1931, the effective date of its recent order in the western grain rate decision. The statement also suggests a more liberal attitude on the part of public authority toward fourth section relief so as to enable the railways to compete with water carriers; recommendations to Congress for legislation regulating motor vehicle transportation and the transportation of artificial and natural gas; an investigation and study by the commission of inland water-way transportation, its cost and the effect of this competition on rail carriers; and that there be a stoppage of the constant erosion of the rate structure. At a special conference on December 5, the commission postponed the effective date of its order in the western grain rate case from January 1 to April 1, 1931.

ASSOCIATION NEWS

Metropolitan Track Supervisors' Club

The Metropolitan Track Supervisors' Club met on December 18 with 32 members and guests in attendance. The principal feature of the meeting was the presentation of a paper by A. E. Preble, supervisor on the Pennsylvania at Pottsville, Pa., on the subjects of Track Scrap Accumulation and Disposition, and Practical Advantages of a Neat and Clean Right-of-Way.

Maintenance of Way Club

Eighty-four members and guests attended the meeting of the club on December 17, when A. F. Blaess, chief engineer of the Illinois Central, presented a paper on "Slides and Other Roadbed Problems." An abstract of Mr. Blaess' paper will appear in a later issue. The next meeting of the club will be held at the Auditorium Hotel on January 21.

Bridge and Building Association

The members of the Executive committee met at the Engineers Club, Chicago, on December 13. A report from the committee appointed to perfect arrangements for the convention in Toronto, Ont., on October 20-22, was presented in which it was recommended that the Royal York hotel be selected as convention headquarters, which report was approved. This committee also reported tentative arrangements for visiting points of engineering interest enroute to and following the convention. The Executive committee then selected the personnel of committees to report at the next convention on the eight subjects chosen at the last meeting for consideration during the year.

American Railway Engineering Association

The reports of all of the committees except one have been completed and turned over to Secretary Fritch, and practically all of them are now in type. The first bulletin containing the reports of five committees was mailed to the members early in December and another one with five more reports was mailed during the closing days of the month. Other bulletins will appear weekly, concluding with the February bulletin early in that month. A characteristic of the reports this year is that, with one or two exceptions, they are materially shorter than in previous years.

President Brooke has called a meeting of the Board of Direction at Chicago on the morning of January 6. The Arrangements committee will meet on the afternoon of the same day to put into effect such action as the board may initiate with reference to the next convention.

The list of committees for 1931 includes a new one, a Special Committee on Waterproofing Railway Structures, the personnel of which is made up of five representatives from each of the committees on Buildings, Masonry and Iron and Steel Structures, no chairman being designated by the Board of Direction. The personnel of committees also shows seven changes in chairmen as follows: Track, C. R. Harding, assistant to president, S. P., San Francisco, Cal., who succeeds J. V. Neubert, engineer maintenance of way, N. Y. C., New York; Masonry, Meyer Hirschthal, concrete engineer, D. L. & W., Hoboken, N. J., who succeeds C. P. Richardson, engineer track elevation, C. R. I. & P.; Grade Crossings, J. G. Brennan, engineer of grade crossings, N. Y. C., New York, who succeeds F. Ringer, chief engineer, M-K-T., St. Louis, Mo.; Signals and Interlocking, P. M. Gault, signal engineer, M. P., St. Louis, Mo., who succeeds W. M. Post, assistant signal enginneer, Pennsylvania, Philadelphia, Pa.; Uniform General Contract Forms, F. L. Nicholson, chief engineer, N. S., Norfolk, Va., who succeeds J. C. Irwin, valuation engineer, B. & A., Boston, Mass.; Rivers and Harbors, E. A. Hadley, chief engineer, M. P., St. Louis, Mo., who succeeds Wm. G. Atwood, consulting engineer, New York City; and the Special Committee on Standardization, J. C. Irwin, valuation engineer, B. & A., Boston, Mass., who succeeds W. C. Cushing, engineer of standards, Pennsylvania, Philadelphia, Pa.

The Nominating committee has presented its report to the Board of Direction and ballots containing these nominations will be distributed to the members about January 15. The nominations are as follows:

President, L. W. Baldwin, president, M. P.

Vice-president, W. P. Wiltsee, chief engineer, N. & W.

Secretary, E. H. Fritch.

Treasurer, A. F. Blaess, chief engineer, I. C.

Directors (three to be elected) W. C. Barrett, trainmaster, L. V.; E. A. Hadley, chief engineer, M. P.; T. T. Irving, chief engineer (central region) C. N.; J. C. Irwin, valuation engineer, B. & A.; F. R. Layng, assistant chief engineer, B. & L. E.; S. S. Roberts, assistant director, bureau of finance, I. C. C.; C. H. Stein, assistant to president, C. R. R. N. J.; Hermann von Schrenk, consulting timber engineer; A. R. Wilson, engineer bridges and buildings, Pennsylvania.

Members of Nominating committee (five to be elected): Wm. G. Atwood, consulting engineer; C. W. Baldridge, assistant engineer, A. T. & S. F.; G. F. Hand, general assistant engineer, N. Y., N. H. & H.; E. M. Hastings, chief engineer, R. F. & P.; A. N. Reece, chief engineer, K. C. S.; R. T. Scholes, assistant to chief engineer, C. B. & Q.; W. D. Simpson, assistant engineer maintenance of way, S. A. L.; C. H. Tillett, signal engineer, C. N.; S. T. Wagner, consulting engineer, Reading; C. C. Williams, dean, College of Engineering, University of Iowa.

Roadmasters Association

The members of the Executive committee met at the Hotel Stevens, Chicago, on December 6 to transact the current business of the association and appoint standing committees for the new year. The report of the committee appointed to investigate hotels recommended that the next convention return to the Hotel Stevens, Chicago, which report was approved. Secretary Donahoe reported that the transcript of the last convention is now being edited and that the advertising for the Proceedings is being secured on a schedule that should insure their appearance early in February. The Executive committee then selected the personnel of committees to investigate and report at the next convention on the subjects selected at the recent convention, these selections being made largely from the more than 60 members who volunteered for this work.

Wood Preservers Association

The program for the twenty-seventh annual meeting, which will be held at the Ben Franklin Hotel, Philadelphia, Pa., on January 27-29, is as follows:

Tuesday Morning

Opening exercises.

Address of President C. C. Cook, maintenance engineer, B. & O.

Report of secretary-treasurer, Horace L. Dawson.

Tuesday Afternoon

Report of Committee on Preservatives, W. H. Fulweiler, chairman, chemical engineer, Philadelphia Gas Works Company.

Report of Committee on Processing of Wood, A. W. Armstrong, chairman, president and general manager, Ayer & Lord Tie Company.

Paper on Additional Experiments in Fireproofing Wood, by George M. Hunt, T. R. Truax and C. A. Harrison, Forest Products Laboratory.

Paper on the Relationship Between Toxicity and Permanence of Coal Tar Creosote, by Ernest Bateman, senior chemist, Forest Products Laboratory.

Report of Committee on the Treatment of Car Lumber, James R. McGrenera, chairman, general tie and timber inspector, A. T. & S. F.

Report of Committee on Douglas Fir Lumber, R. H. Rawson, chairman, consulting engineer.

Report of Committee on the Pressure Treatment of Poles, A. E. Fant, chairman, president Gulfport Creosoting Company.

Report of Committee on the Non-Pressure Treatment of Poles, J. D. Burnes, chairman, engineer wood preservation, Page & Hill Company.

Wednesday—Users' Day

Report of Committee on Tie Service Records, W. R. Goodwin, chairman, engineer wood preservation, M. St. P. & S. St. M.

Report of Committee on the Treatment of Bridge and Structural Timber, G. A. Haggander, chairman, bridge engineer, C. B. & Q.

Report of Committee on Pole Service Records, A. H. Haenseler, chairman, engineer, Western Union Telegraph Company.

Report of Committee on the Treatment of Posts, F. E. McCrory, chairman, chief tie inspector, C. R. I. & P.

Paper on the Diversity of Uses of Treated Timber, by R. S. Belcher, manager treating plants, A. T. & S. F.

Paper on the Use of Treated Timber in Construction by F. O. Dufour, consulting engineer, United Engineers and Constructors, Inc.

Paper on Twenty-one Years' Experience with Treated Ties on the Lehigh Valley, by C. B. Musselman, chief treating inspector, L. V.

Thursday, January 29

Report of Committee on Plant Operation, H. W. Foster, chairman, superintendent Kettle River Treating Company.

Report of Committee on Terminology, E. B. Fulks, vice-president, American Creosoting Company, Inc.

Report of Committee on Moisture Content Determination, R. E. Myers, chairman, chemist, International Creosoting & Construction Company.

Progress report on International Termite Exposure Tests by George M. Hunt, Forest Products Laboratory, and T. E. Snyder, U. S. Bureau of Entomology.

Paper on Results Obtained by Marine Piling Experiments, by J. D. MacLean, Forest Products Laboratory.

Paper on Recent Experiments on the Toxicity of a Number of Possible Wood Preserving Chemicals, by Ira Hatfield, Forest Products Laboratory.

Address on Some Recent Observations of Wood Preservation in Europe, by Dr. Hermann Von Schrenk, consulting timber engineer.

Report of Joint Committee to Determine the Strength of Douglas Fir With Relation to Moisture Content, W. E. Hawley, chairman, assistant engineer, D. M. & N.

Report of Service Bureau Board, A. R. Joyce, chairman, vice-president, Joyce Watkins Company.

Closing business.

Arrangements have been made for the members from the west enroute to the convention to travel in special sleeping cars via the B. & O., leaving St. Louis at 12:17 noon on Sunday, January 25, Louisville, at 5 p. m., Chicago at 8:30 p. m. and Cincinnati at 9:40 p. m., which cars will be assembled at Pittsburgh into a special train leaving that city at 9 a. m. Monday, stopping enroute at Green Spring, W. Va., for an inspection of the B. & O. treating plant, and reaching Philadelphia at 8:20 Monday evening.

SUPPLY TRADE NEWS

The American Hoist & Derrick Co., St. Paul, Minn., has purchased warehouse facilities in Chicago.

The American Manganese Steel Company, Chicago Heights, Ill., has acquired an exclusive license from Grover C. Voit to manufacture and sell the Voit dipper front.

The R. H. Hyland Company, 225 West Huron street, Chicago, has been appointed the representative of the **Verona Tool Works,** Pittsburgh, Pa., for the Chicago territory to succeed **Porter Laughlin,** resigned.

The Southern Manganese Steel Division of the **American Manganese Steel Company** has transferred all matters pertaining to sales from St. Louis, Mo., to the general offices of the American Manganese Steel Company, Chicago Heights, Ill.

The manufacture and distribution of Hackman trackliners and lining bars, heretofore handled by the **Hackman Railway Supply Company,** will hereafter be handled by the **Hackman Trackliner Company,** a newly organized company with headquarters at 431 South Dearborn street, Chicago, under the direction of **Clyde Tompkins,** sales manager.

J. B. Downey, 2644 North Second street, Phoenix, Ariz., has been appointed district sales representative of the **Dayton-Dowd Company,** Quincy, Ill., for the state of Arizona.

The general office of **A. E. Pratt,** manager, and the eastern office of **F. H. Crawford,** manager of the transportation sales department of **E. I. du Pont de Nemours & Company, Inc.,** Wilmington, Del., will be moved on January 2 from Parlin, N. J., to 1616 Walnut street, Philadelphia, Pa. This department handles the sale of paint and varnish products to steam railroads, electric railways and the marine industry.

A. W. Willcuts, assistant manager of the railroad sales department of Joseph T. Ryerson & Son, Inc., with headquarters at St. Louis, Mo., died on December 14 from heart failure.

New Passenger Cars

The Chesapeake & Ohio and the Pere Marquette have recently placed in service 38 passenger cars having 15 single seats on one side of the car and 15 double seats on the opposite side, making the total seating capacity 45. The seats are of the bucket revolving type and in the single row the seats may be turned in any direction without interference with any passenger. Each seat is opposite a window so that the window posts do not interfere with the vision.

PERSONAL MENTION

General

W. A. Peavy, chief engineer of the Sabine & Neches Valley, with headquarters at Shreveport, La., has been appointed assistant to the president, with the same headquarters.

F. G. Hoskins, superintendent of the Baltimore division of the Baltimore & Ohio, and an engineer by training and experience, has been appointed general superintendent of the Maryland district, with headquarters as before at Baltimore, Md. Mr. Hoskins was born on July 25, 1883, at Philadelphia, Pa., and was educated at Drexel Institute and the University of Pennsylvania, graduating from the latter in 1907 with a degree in civil engineering. He commenced his railway career on August 1 of the same year as a draftsman in the bridge department of the B. & O. He was advanced successively through the positions of assistant division engineer, assistant engineer and division engineer on the Connellsville and Philadelphia divisions and in 1916 he was promoted to superintendent of the Ohio River division, later being transferred to the Wheeling division. During the war Mr. Hoskins was engaged in the handling of troops and supplies with the American Railway Association and the United States Railroad Administration. In 1919 he was appointed superintendent of the Baltimore Terminals of the B. & O., and in 1921 he was transferred to the Baltimore division, with headquarters at Baltimore, which position he held until his recent promotion.

F. G. Hoskins

Charles S. Millard, an engineer by training and experience and for the last six years general manager of the Cleveland, Cincinnati, Chicago & St. Louis, has been elected vice-president and gen-

eral manager, with headquarters as before at Cincinati, Ohio. He was born on May 3, 1874, at Louisville, Ky., and was educated at the Sheffield Scientific School of Yale University, from which he graduated in 1896. He entered railway service in the same year as a rodman in the engineering department of the Pennsylvania. In 1897 he went with the Peoria & Eastern as assistant in the engineering department, being in 1898 promoted to assistant engineer. Shortly thereafter Mr. Millard left the service of this road to serve for several months in the Spanish-American war, returning to the Peoria & Eastern in October, 1899, as engineer maintenance of way. In 1901 he was appointed second assistant engineer of the Delaware, Lackawanna & Western, but resigned later in the same year to become engineer maintenance of way of the Peoria & Pekin Union. In 1902 he left this road to become an assistant engineer on construction with the Illinois Central at Memphis, Tenn., returning to the Peoria & Pekin Union a year later as engineer maintenance of way. In 1906 Mr. Millard was appointed engineer maintenance of way of the Big Four and later served successively on this road as engineer of track and roadway and superintendent of the Michigan division and later the Chicago division. In 1914 he was appointed division superintendent of the Peoria & Eastern and in 1916 he was appointed superintendent of the St. Louis division of the Big Four, being appointed assistant general superintendent in 1918. He was promoted to general manager in April, 1924, which position he retained until his recent election as vice-president and general manager, effective December 15.

Charles S. Millard

Walter H. Edwards, cost engineer of the Baltimore & Ohio, with headquarters at Baltimore, Md., has been appointed general superintendent of the Lehigh & New England, with headquarters at Bethlehem, Pa. He was born on January 29, 1890, at Wilmington, Del., and graduated from Bucknell University with a degree in civil engineering in 1913. He also attended the Harvard University summer school. Mr. Edwards began his railroad career in August, 1909, in the construction department of the Baltimore & Ohio, where he remained until September, 1910, when he left that railroad to complete his education. He returned to the B. & O. in September, 1913, as an assistant on the engineering corps, and in March, 1915, he was appointed a draftsman in the architect's office at Baltimore, Md. From June, 1915, until May, 1916, he was employed in the Bureau of Valuation of the Interstate Commerce Commission in connection with the federal valuation of railroads, being assigned to roadway field inventory duties. In May, 1916, Mr. Edwards returned to the B. & O. as office draftsman in its valuation department, and in March, 1916, he was appointed cost engineer, which position he held until he left the service on December 1, to take up his new duties.

Engineering

A. A. Mathews, chief engineer of the Denver & Salt Lake, with headquarters at Denver, Colo., has resigned.

R. E. Butler, whose promotion to chief engineer of the Newburgh & South Shore, with headquarters at Cleveland, Ohio, was noted in the November issue, was born on April 1, 1890, at Brecksville, Ohio. He was educated at the Western Reserve University and the Case School of Applied Science, graduating from the latter with a degree in civil engineering in 1920. Mr. Butler commenced his railway career on February 1, 1916, as a construction engineer on the N. & S. S. and has remained with that company continuously to the present. In April, 1918, he was promoted to assistant engineer maintenance of way and in June, 1925, he was further advanced to engineer maintenance of way, with headquarters as before at Cleveland. He was holding the latter position at the time of his recent promotion to chief engineer.

R. E. Butler

H. H. Smith, assistant division engineer on the Nebraska division of the Union Pacific, with headquarters at Omaha, Neb., has been appointed office engineer on the same division and with the same headquarters. The position of assistant division engineer of the Nebraska division has been abolished.

J. A. Peabody, whose appointment as engineer of maintenance of the Chicago & North Western, with headquarters at Chicago, was noted in the December issue, has been connected with this road for 32 years, 28 of which have been as signal engineer. He was born on February 5, 1870, at Chicago and commenced his railway career in June, 1888, as a rodman and instrumentman on the Baltimore & Ohio, at Zanesville, Ohio. In 1892, Mr. Peabody was appointed instrumentman on location, with headquarters at Pittsburgh, Pa., and in 1894, he left railway service to become chief draftsman of the Paige Iron Works, Chicago. In 1898, he returned to railway service as a roadmaster on the Chicago & North Western, in which position he served successively at Tracy, Minn., Ashland, Wis., and Milwaukee. In 1902, he was promoted to signal engineer with headquarters at Chicago, which position he was holding at the time of his recent promotion to engineer of maintenance. Mr. Peabody served the Railway Signal Association, now the Signal Section, A. R. A., as president in 1907.

J. A. Peabody

C. T. Dike, whose promotion to chief engineer of the Chicago & North Western, with headquarters at Chicago, was mentioned in the December issue, was born on August 13, 1871, at Woodstock, Ill., and was educated at Cornell College, Iowa, from which he graduated in 1893, later taking a post-graduate course in civil engineering. Mr. Dike entered railway service in April, 1890, as a chainman on the Northern Pacific. In 1896, he was appointed chief engineer of the Mason City & Clear Lake, with headquarters at Mason City, Iowa. In 1898, he went with the Iowa, Minnesota & Northwestern (now part of the C. & N. W.) as chief engineer and from 1899 to 1901 he served as resident engineer on the C. & N. W. in charge of the location and construction of the I. M. & N. W. From the latter date until 1902, Mr. Dike served in a similar position with the Peoria & North Western and the Verdigre extension of the C. & N. W. In 1903, he was

appointed division engineer on the C. & N. W., serving in this position and as resident engineer in charge of the location and construction of various branch lines until 1907, when he was appointed

C. T. Dike

superintendent of the Pierre, Rapid City & North Western (part of the C. & N. W.). From 1909 until 1910, he served as engineer and superintendent of construction of various new line projects of the North Western, including the Belle Fourche Valley and the James River Valley. In 1911, Mr. Dike was promoted to general superintendent of the Minnesota and Dakota divisions, with headquarters at Huron, S. D., and, during federal control of the railroads, he served successively as assistant general superintendent at Boone, Iowa, and assistant general manager at Omaha, Neb. In 1920, following the termination of federal control, Mr. Dike was appointed engineer of maintenance, holding this position until his recent promotion to chief engineer.

Coincident with the absorption of the Montana division of the Oregon Short Line by the Utah and Idaho divisions, on December 1, **W. C. Perkins,** division engineer of the Montana division has been transferred to the Utah division, succeeding **M. H. Brown, Jr.,** who has been transferred to the Idaho division, succeeding **E. E. Moberly,** who has been assigned to other duties. The headquarters of these officers are located at Pocatello, Idaho.

As a result of the consolidation of divisions on the New York, New Haven & Hartford, in which the Waterbury and Old Colony divisions have been abolished, **R. J. Bieth,** division engineer of the Waterbury division, with headquarters at Waterbury, Conn., has been appointed to the newly created position of assistant division engineer on the Hartford division, with headquarters at Hartford, Conn. **S. A. Kinzie,** division engineer of the Old Colony division, with headquarters at Taunton, Mass., has been transferred to the Boston division, with headquarters at Boston, Mass., succeeding **J. B. Bell,** who has been appointed to the newly created position of assistant division engineer on the Providence division, with headquarters at Providence, R. I.

C. W. VanNort, division engineer on the Erie & Ashtabula division of the Pennsylvania, with headquarters at New Castle, Pa., has been transferred to the Pittsburgh division, with headquarters at Pittsburgh, Pa., succeeding **R. W. E. Bowler,** who has been promoted to engineer maintenance of way of the Northern division, with headquarters at Buffalo, N. Y., to take the place of **C. L. Barnaby,** whose death is noted elsewhere in these columns. Mr. Bowler was born at Washington, D. C., on January 16, 1883, and received his higher education at the University of Delaware, from which he graduated in 1905. He obtained his first railway experience during the summers of 1902 and 1903, while in college, acting as a rodman on the Maryland division of the Pennsylvania. Immediately following his graduation from college, in June, 1905, he entered the service of the Pennsylvania as a rodman, with headquarters at Wilmington, Del. On November 1, 1908, he was promoted to transitman, and on November 16, 1909, he was made assistant supervisor of track at Media, Pa. Following several transfers, which took him to Columbia and Harrisburg, Pa., Mr. Bowler was

R. W. E. Bowler

promoted to supervisor on January 1, 1916, with headquarters at South Fork, Pa. Later he was transferred to Parkton, Md., and then to Washington, D. C., and on May 1, 1923, he was promoted to division engineer of the Mackinaw division, with headquarters at Grand Rapids, Mich. On August 1 of the same year, he was transferred to the Toledo division, with headquarters at Toledo, Ohio, and on January 16, 1927, he was again transferred to the Pittsburgh division, with headquarters at Pittsburgh, Pa. Mr. Bowler's promotion to engineer maintenance of way of the Northern division became effective on December 15.

Track

H. E. Durham has been appointed roadmaster on the Kansas City Southern, with headquarters at Grandview, Mo., succeeding **J. W. Griffith,** who has been transferred to Pittsburg, Kan. Mr. Griffith relieves **W. L. Spyres,** who has been transferred to Heavener, Okla., succeeding **G. T. Anderson,** who has been transferred to Neosho, Mo. Mr. Anderson succeeds **M. A. Box,** whose death was noted in the December issue.

J. Prybylski, supervisor on the Michigan Central, with headquarters at Toledo, Ohio, has been transferred to Monroe, Mich., on the New York Central, succeeding **L. A. Clayman,** who has been transferred.

C. R. Sanders, assistant supervisor on the Eastern division of the Pennsylvania, with headquarters at Canton, Ohio, has been transferred to the Buffalo division.

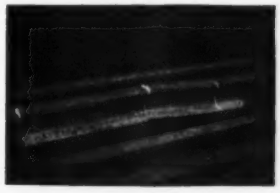
A. M. Anderson, roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Ellensburg, Wash., has moved his headquarters to Cle Elum, Wash.

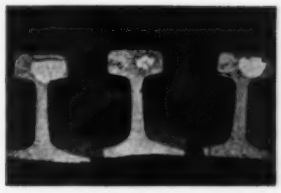
William Rinalvi has been appointed assistant supervisor of track on Subdivision 3 of the Eastern division of the New York Central, with headquarters at Beacon, N. Y., succeeding **A. J. Flanagan,** who has been transferred to Subdivision 2, with headquarters at New York. **R. L. Sahn,** assistant supervisor on Subdivision 13B, with headquarters at Lackawanna, N. Y., has been transferred to Subdivision 25, with headquarters at Jersey Shore, Pa., succeeding **P. V. Garrison,** who has taken his place at Lackawanna.

R. L. Haring, supervisor on special duty on the Long Island unit of the New York zone of the Pennsylvania, has been appointed supervisor, Long Island improvements, with headquarters at Jamaica, N. Y., succeeding **Lee Spencer,** who has been appointed supervisor on Subdivision No. 1, with headquarters at Woodside, N. Y. Mr. Spencer succeeds **F. T. Fish,** who has been transferred to the New York zone with headquarters at Bordentown, N. J. **F. H. DeMoyer,** supervisor on the New York zone at Jamesburg, N. J., has been appointed assistant supervisor on Subdivision No. 2 of the Long Island, with headquarters at Jamaica, succeeding **E. L. Wingfield, Jr.,** who has been transferred to Bordentown.

H. W. Clarkson, roadmaster on the Edmonton division of the Canadian Pacific, with headquarters at Coronation, Alta., has been transferred to the Medicine Hat division, with headquarters at Leader, Sask., succeeding **R. D. Currie,** who has in turn been transferred to Coronation, to succeed Mr. Clarkson. **J. Daem,** roadmaster on the Medicine Hat division, with headquarters at Maple Creek, Alta., has been transferred to the Calgary division, with headquarters at Banff, Alta., succeeding **A. Larson,** who has been transferred to Calgary, Alta., on the same division, where he succeeds **T. Riordan,** who has retired. **E. Gordon,** roadmaster on the Medicine Hat division, with headquarters at Kneehill, Alta., has been transferred to Maple Creek to succeed Mr. Daem. **A. McDonald,** section foreman with headquarters at Morley, Alta., has been promoted

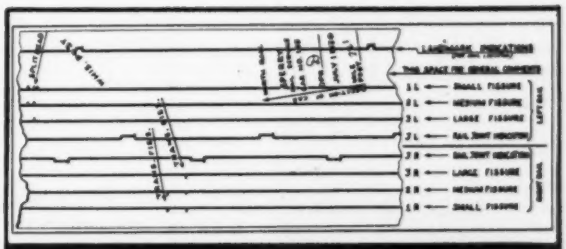
SPERRY Detector Cars ..... *locate hidden rail defects before the fracture stage is reached*





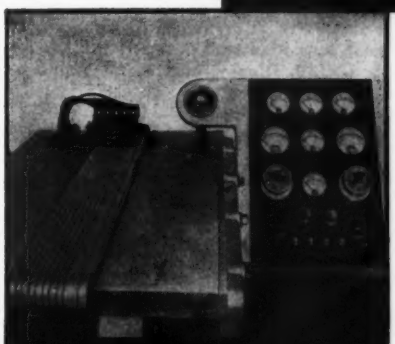
THERE was no way of locating rails weakened by internal defects until the Sperry Detector Car was developed. But now through an ingenious use of electricity and highly sensitive instruments, the interior condition of rails in track can be revealed.

As the Sperry Detector Car moves over the track, eight recording pens and a landmark pen write down the true story of metal conditions within the rail. Large, medium and small defects are instantaneously caught by the accurate detecting mechanism.



The Record

Both rails are tested at the same time. The operator, from his post in the rear of the car, watches the track and the moving record before him. Opposite all indications, he marks the nature of the defect, landmarks for rail location, etc.



Pen Unit and Control Panel

Sperry Rail Service permits improved track maintenance, resulting from removing defective rails from track, and at the same time has definite educational value to track forces.

It forestalls possibility of derailment and resulting damage to track by pointing out the danger before actual rail failure occurs. The record is analyzed by the central office and forwarded to the railroad. It shows exact locations of defective rails as well as the nature of the defect.

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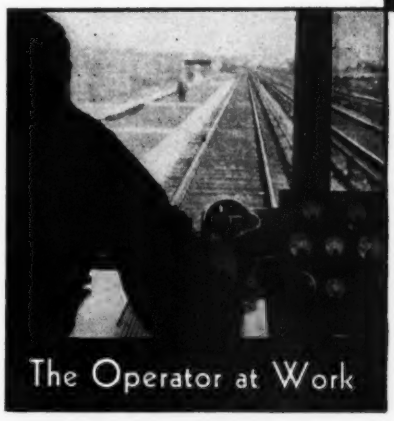
The complete story of Sperry Detector Car operation and advantages is given in Bulletin 57. Would you like a copy?



The Operator at Work

SPERRY PRODUCTS INC.

SPERRY RAIL SERVICE

SPERRY PRODUCTS, INC.

Sperry Building, Manhattan Bridge Plaza, Brooklyn, N. Y.
Chicago Office: 80 East Jackson Blvd.

to roadmaster at Kneehill, succeeding Mr. Gordon. **L. P. Linton** has been appointed roadmaster on the London division, with headquarters at Guelph, Ont., to succeed **A. E. Partushek,** who has been transferred to London, Ont., on the same division. Mr. Partushek replaces **C. J. Francis,** who has been transferred to the Toronto Terminal division, at Toronto, Ont., succeeding **W. H. Noyes,** deceased.

James Moran, general track foreman on the Union Pacific, assigned to the construction of the Omaha union station, with headquarters at Omaha, Neb., has been appointed general roadmaster on the Central division, with headquarters at Marysville, Kan., succeeding **John Esse,** acting general roadmaster, who has been appointed roadmaster on the St. Joseph & Grand Island, a unit of the Union Pacific, with the same headquarters. Mr. Esse replaces **W. P. Bret,** who has been transferred to the Western division, with headquarters at Rock Springs, Wyo., where he succeeds **James Thompson,** who has been assigned to other duties.

Changes on the New Haven

With the consolidation of divisions and subdivisions on the New York, New Haven & Hartford, in which the Waterbury and Old Colony divisions have been abolished, a number of changes have taken place among the track supervisory forces. **G. W. Lintell,** assistant track supervisor, has been promoted to track supervisor on the New Haven division, with headquarters at New Haven, Conn., succeeding **G. A. DeMore,** who has been pensioned. **J. T. Reilly,** track supervisor on the Hartford division, has been pensioned and his position abolished. The Old Colony division has been divided between the Boston and Midland divisions and **F. O. Hillers,** track supervisor on the Old Colony division, has been transferred to the Boston division, but maintains his headquarters at Taunton, Mass., and **C. P. Richmond,** also track supervisor on the Old Colony division, has been transferred to the Midland division, with headquarters still at Framingham, Mass.

As a result of the absorption of the Waterbury division by the Hartford division, **J. H. Smith,** track supervisor on the Waterbury division, has been transferred to the Hartford division, maintaining his headquarters at Waterbury, Conn. **H. B. Butterfield,** track supervisor on the Danbury division, with headquarters at White Plains, N. Y., has been appointed to the newly-created position of assistant track supervisor at the same point, and the position of supervisor has been abolished. Mr. Butterfield now reports to **H. P. Spencer,** supervisor at Poughkeepsie, N. Y. **W. F. Sullivan,** track supervisor at Providence, R. I., has been transferred to the Boston division, with headquarters at South Braintree, Mass., where he succeeds **C. S. Flandreaux,** who has been appointed to the newly created position of assistant track supervisor at that point.

Bridge and Building

J. W. McCarl has been appointed supervisor of bridges and buildings on the Minnesota division of the Chicago & North Western, with headquarters at Winona, Minn., succeeding **P. J. Barlow,** who has retired.

L. Farley, chief carpenter on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Dubuque Shops, Iowa, has been transferred to Ottumwa, Iowa, succeeding **John Evans,** whose death is noted elsewhere in these columns.

H. G. Dalton, assistant engineer of buildings of the Chicago, Burlington & Quincy, with headquarters at Chicago, has been promoted to engineer of buildings with the same headquarters, succeeding **Walter T. Krausch,** whose death is noted elsewhere in these columns.

Lloyd Castagneto, assistant bridge and building supervisor on the Oregon Short Line, with headquarters at Nampa, Idaho, has been promoted to bridge and building supervisor with the same headquarters, a newly created position. **N. D. Brookhart,** bridge and building supervisor of the Montana division, with headquarters at Pocatello, Idaho, has been transferred to the Utah division, with headquarters at Salt Lake City, Utah, succeeding **G. A. Meier,** who has been assigned to other duties.

In a readjustment of divisions and subdivisions on the New York, New Haven & Hartford, in which the Waterbury and Old Colony divisions have been absorbed by other divisions, **E. E. Candee,** bridge and building supervisor, with headquarters at Waterbury, Conn., has been pensioned and his position abolished. **J. J. Rippey,** bridge and building supervisor on the Old Colony division, with headquarters at Taunton, Mass., has been appointed district bridge foreman on the New Haven division, with headquarters at New Haven, Conn., succeeding **C. W. Beebe.**

Obituary

Dan Lawler, who retired in 1923 as a master carpenter on the Iowa lines of the Chicago, Burlington & Quincy, died on December 16 at Ottumwa, Iowa.

C. L. Barnaby, engineer maintenance of way of the Northern division of the Pennsylvania, with headquarters at Buffalo, N. Y., died on December 4, 1930.

John Evans, chief carpenter on the Kansas City division of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Ottumwa, Iowa, died on October 24.

Carl C. Witt, supervising engineer in the Bureau of Valuation of the Interstate Commerce Commission, and formerly chief draftsman on heavy track and bridge construction on the Chicago & North Western, died at Washington, D. C., on December 16.

J. D. Evans, formerly an engineer on railway construction in Canada, and at one time bridge and building superintendent on the Canadian National, died suddenly at Toronto, Ont., on November 7, at the age of 87 years.

Walter T. Krausch, engineer of buildings of the Chicago, Burlington & Quincy, with headquarters at Chicago, died at his home at La Grange, Ill., on December 9, after an illness of several months. He was born at Philadelphia, Pa., on June 11, 1869, and was educated at a technical school at Buffalo, N. Y., and by private tutoring. From 1888 to 1890 he was associated with his father in Theodore Krausch & Co., architects and engineers, at Buffalo, in the design and construction of coal storage, refrigerating and power plants. He entered railway service in February of the latter year in the engineering department of

Walter T. Krausch

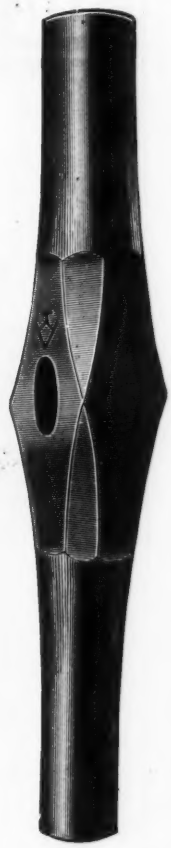
the Burlington at Chicago, and later was appointed architect. In December, 1905, he left railway service to become associated with the engineering and mechanical department of Fairbanks, Morse & Co. He returned to railway work in 1912 as engineer of buildings of the Burlington, which position he held continuously until his death. Mr. Krausch was active in the work of the American Railway Bridge and Building Association, of which organization he was third vice-president at the time of his death.

Colorado & Southern Track in New Mexico

VERONALLOY

THE SAFETY TOOLS

CHISE



MAUL

SLEDF

Veronalloy Tools Forged From High-Grade
Shatter Proof None Flying
Veronalloy Steel

Safety First *Use Them To Lay 1931 Rail*

VERONA TOOL WORKS

1800 First National Bank Building

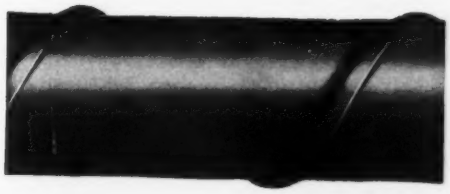
PITTSBURGH, PA.

1873

CLASSIFIED INDEX TO ADVERTISERS

Authoritative Tests Prove...
High Tensile and Compression Strength of LIGHT WEIGHT Naylor Pipe

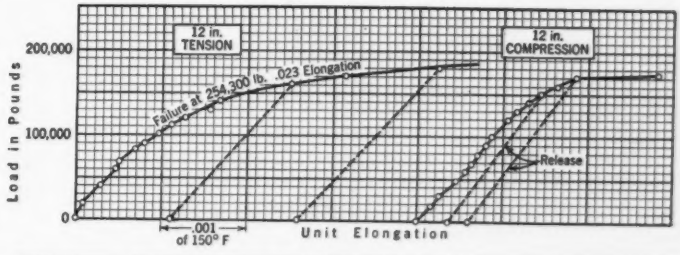
No. 3—Longitudinal Tension and Compression Tests



Pipe in service is subjected to considerable stress caused by variations in temperature. The tendency to expand or contract caused by temperature changes may put heavy longitudinal stresses on pipe.

The ability of the Naylor Pipe structure to withstand these stresses was tested by Professor M. L. Enger and W. M. Lansford at the Materials Testing Laboratory of the University of Illinois.

The tests showed Naylor Pipe to have great elongation in tension. For example, 12-inch Naylor Pipe stretched 0.023 inches per inch at a load of 254,300 lbs. In the case of the compression specimens, the deformations were much smaller.



Catalog 30-2 gives more complete engineering and metallurgical data.

In the above chart, the load in pounds is plotted against the unit-elongation. Since the unit-elongation is directly proportional to the change in temperature, it is evident that the horizontal scale may also be used as a temperature scale. Steel elongates about 0.001 of an inch per inch for a change of temperature of 150° F.

These tests show that, due to its unique structure, Naylor Pipe can withstand large temperature variations without being subjected to heavy temperature stresses.

NAYLOR PIPE COMPANY, Main Office & Plant, 1230 E. 92nd St., CHICAGO

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CHAMPION & BARBER, Inc.
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TONCAN COPPER

Naylor Pipe

Maximum Structural Strength — Mo-lyb-den-um IRON — With Minimum Weight

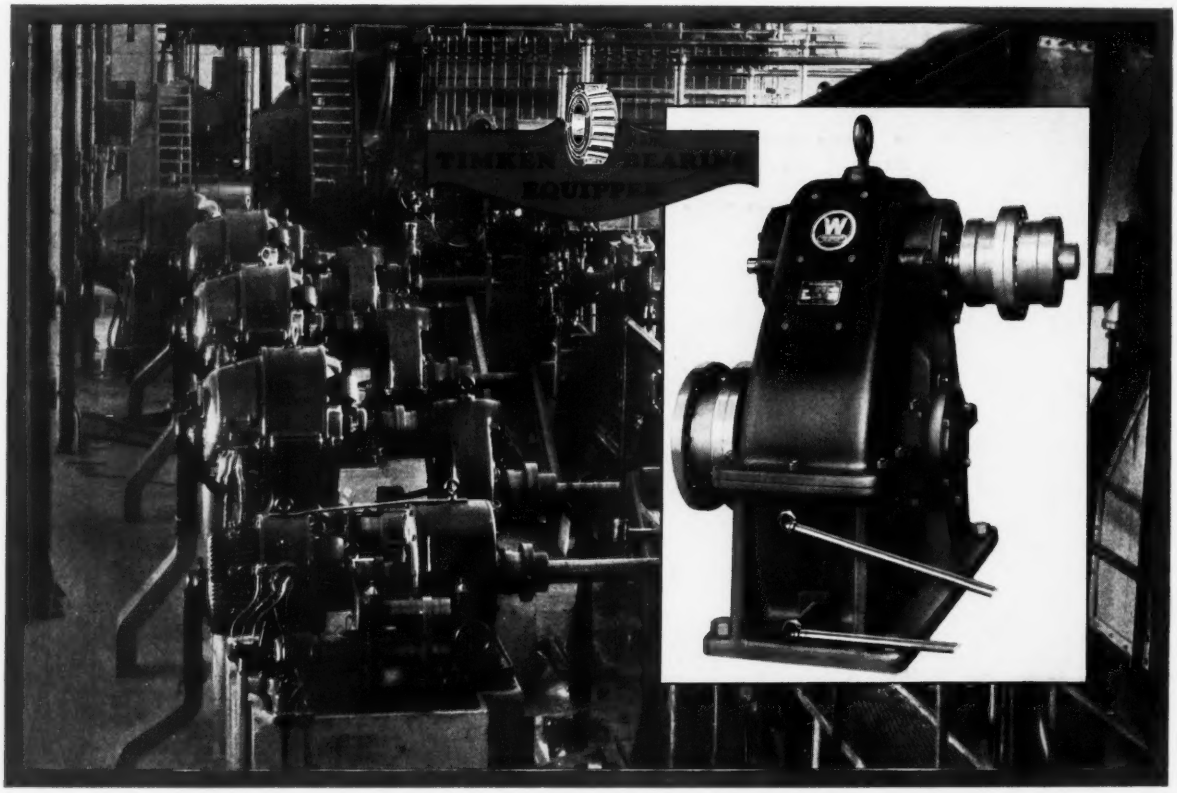
Standardized Naylor Pipe is made in sizes 6" to 12" I. D. and 14" to 20" O. D. in any uniform length desired up to 40'0". Ends made to wrought pipe standards for all types of coupling.

Toncan Copper Molybdenum Iron possesses a superior corrosion resistance making it the favored pipe material.

Where corrosion is not a problem, Naylor Pipe can be furnished in steel.

CLASSIFIED INDEX TO ADVERTISERS—(Continued)

ALPHABETICAL INDEX TO ADVERTISERS



These Timken Bearings Have Run 70 Times the Life of the Average Automobile

The pinion bearings in the 6 Westinghouse-Nuttall gear reduction units at the Washington Pulp and Paper Company have each rolled up the enormous total of over 2,338,000,000 revolutions, and a recent check-up shows that they are good for many millions more.

Loaded 100% of their Timken catalogue rating, they have averaged 6¼ days per week, 24 hours a day since they were installed in April, 1923.

The total distance traveled by each of these bearings is the equivalent of driving an automobile more than 3,500,000 miles, whereas the average automobile travels but 50,000 miles during its entire life.

A worthy tribute to Timken stamina! Don't you want this same unequalled endurance in section cars, inspection cars, crossing gates, turntables and all other equipment you use? The Timken Roller Bearing Company, Canton, Ohio.

TIMKEN *Tapered Roller* **BEARINGS**